

THE
WATER SUPPLY
TO THE
RURAL DISTRICTS OF ESSEX.

REPORT

PRESENTED TO

THE COUNTY COUNCIL,

April 4th, 1905,

BY

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Medical Officer of Health.

CHELMSFORD :

PRINTED BY JOHN DUTTON, 8, TINDAL STREET.

1905.



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WATER SUPPLIES

IN THE

RURAL DISTRICTS OF ESSEX.

INTRODUCTION.

At the meeting of the County Sanitary Committee held at New Broad Street, London, on February 9th, Mr. Andrew Johnston, Chairman of the County Council, read the following resolution which had been forwarded to him by the Earl of Warwick, Lord Lieutenant of the County, at the request of a meeting which had been held in these offices to consider the question of the unemployed:—

“That the Chairman (the Earl of Warwick) be asked to communicate with the Essex County Council with reference to the migration of the rural population to the large towns and the necessity of making some effort to keep the people upon the land and the desirability of the County Council taking some steps to provide better cottages for the Working Classes and the necessity of the Government advancing money at low rates of interest for this purpose and also for the provision of a better water supply for the villages within the county.”

Mr. Johnston suggested “that the County Medical Officer of Health, who had previously prepared a report on the water supplies to the whole county, be asked to prepare for the County Council a further report bringing the information as far as possible up to date and dealing only

with the Rural Districts.” The Committee approving the suggestion, I was asked to prepare such a report and, if possible, submit it to the Council at its next meeting on April 4th. This I undertook to do and the report is submitted herewith.

There is no doubt that the subject is an important one and one about which there is much misapprehension. Because a few localities find great difficulty in obtaining water, the opinion widely prevails that the whole county is very badly provided with water and that much discomfort and disease is consequent thereon. This report will, I hope, dispel these illusions, for the county is probably as well supplied with water as any other in the kingdom, and typhoid fever and diarrhoea, the chief water borne diseases, are far less prevalent than in towns with public supplies. Moreover, in certain of the rural districts there are public supplies of a model character with water mains ramifying over wide areas.

Another erroneous opinion worth referring to is that the county is flat and uninteresting. This impression can only be formed by those whose sole knowledge of it is derived from observations made whilst on the Thames or on the sea. It is undoubtedly bounded on these two sides by extensive tracts of marshes or flat lands, but elsewhere it is undulating, well wooded, and in places picturesque. Many of the elevations are capped with gravel, command extensive views, and are admirably adapted for private residences, sanatoria, convalescent homes, labour colonies, and for colonization by those who desire to enjoy the advantages of a country life. Moreover, the county is exceedingly healthy. It is doubtful whether there is a healthier one within the three kingdoms, and, as it is so near London, it is obvious that it possesses many advantages.

As this report is going through the press, articles and letters are appearing in the daily papers with reference to the alleged advantages of soft water. The general public appear to have the idea that hard waters cause gout and stone, and that soft water tends to cause rickets in children. There is no proof that either view is correct, but there is no doubt that soft water is better adapted for general domestic purposes than hard water. In Essex the two extremes are found, certain districts are supplied with very soft waters and others with very hard. Shallow wells yield water which varies very much in character, but as a rule, if the water is derived from superficial gravel and sand, it will be fairly soft. If derived from boulder clay or from the sand beneath the boulder clay, or from chalk it is almost invariably hard. The water from deep wells in central and south-east Essex is generally very soft, elsewhere it is hard. The water supplied to the groups of parishes by the public works owned by the Chelmsford, Maldon and Rochford Rural District Councils respectively is all "soft" so that anyone wishing to reside in an area supplied with such water can with confidence select one of the parishes in these areas. The water supplied by the South Essex Co. and the Tendring Hundred Water Company is "hard" as is also that supplied by the Herts and Essex Water Co.

Persons wishing to settle in any particular parish should make enquiries with reference to the water supply before arriving at any decision. If the information is not contained in this report it can possibly be obtained from the local Medical Officer of Health or from myself and, if available, will always be gladly given.

JOHN C. THRESH.

CHELMSFORD AND

LONDON HOSPITAL MEDICAL COLLEGE,

LONDON, E.

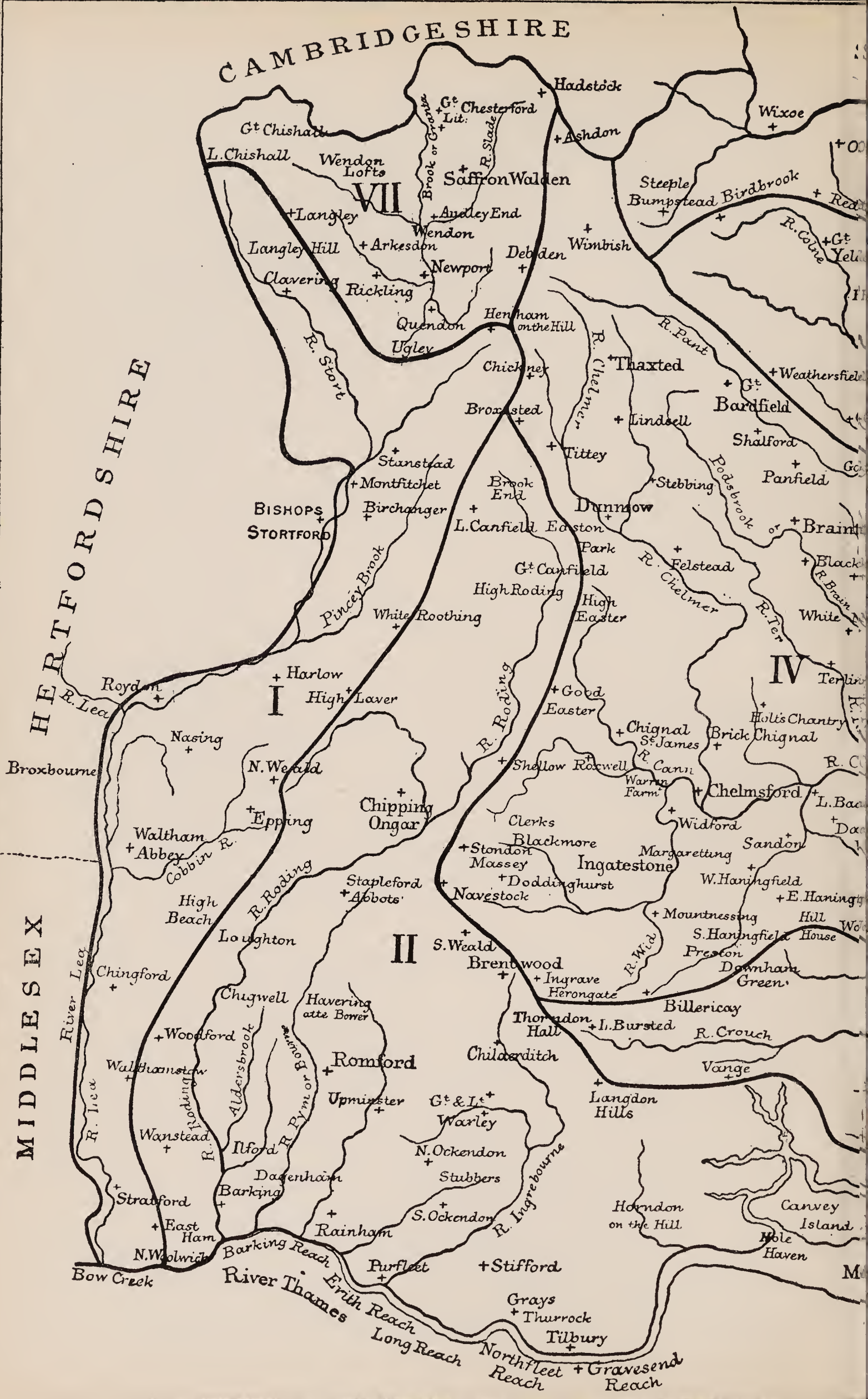
March, 1905.

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ADDENDUM—omitted from page 56—

Rivenhall, population 626, subsoil clay and gravel supplied entirely from private wells, the water from which is not entirely satisfactory.





SCALE : $6\frac{1}{2}$ miles to One Inch

THE WATER SUPPLIES

TO THE

RURAL DISTRICTS OF ESSEX.

The county of Essex comprises an area of close upon one million acres, forming almost a square, bounded on the south by the River Thames, on the east by the North Sea, on the north by the River Stour, and on the west by the River Lee and its tributary the Stort.

The population also is close upon one million, but the larger portion is in the urban districts just over the borders of the metropolis. The rural districts have a population of close upon a quarter of a million and there must be in these districts an average of three acres to each person. So much land has recently been taken up for dairy farming that, doubtless, there are as many cows as families in the rural areas, but the acres and the cows are not uniformly distributed with the population. With five times the present population there is space for each family to have its three acres and a cow.

The county is fairly well supplied with railways, and the development by means of light railways is proceeding so that there are unusual facilities for getting farm and garden produce into London and into the large urban districts on the Essex side where there is an enormous and continually increasing demand.

The county is remarkably healthy. The death-rate in 1902 was only 12·3 per 1,000 population and in 1903 the phenomenally low rate of 11·6 was recorded, whilst

that of England and Wales was 16·3 and 15·4 respectively. In the rural portions of the county the death-rates were even lower, and the average for a long series of years is only 13·1.

The average death-rate from Typhoid Fever in the rural districts is ·13 per 1,000 population which is 50 per cent. lower than for England and Wales. If we exclude certain areas in the Thames Valley the death-rate is only ·08 or less than half that of England and Wales.

A careful and detailed study of the sickness and mortality statistics has led me to the conclusion that Essex is one of the healthiest, if not the healthiest, of English counties, and the low rate of mortality from Typhoid Fever is fairly conclusive proof that the water supply generally is not worse than in other counties. On the contrary I am inclined to think that taking the rural districts as a whole they are better supplied than the majority of rural areas, and I say this from a fairly intimate knowledge of the character of the supplies in many other counties.

Paradoxical as it may appear, Essex, whilst abounding in water, has some difficulty in securing an adequate supply. This is due chiefly to the fact that no well, whether shallow or deep, sunk in any part of the county save the south-west corner, yields a very large quantity, and such springs as occur yield only comparatively limited amounts. But whilst there is this great difficulty in obtaining supplies for the towns and dense centres of population, there is over a large area very little difficulty in obtaining sufficient to supply single houses and groups of houses, and with suitable arrangements the water can be depended upon as being perfectly wholesome in character.

To understand the difficulties relating to supplies of water it is necessary to say a few words with reference to the geology of the county.

Underlying the whole county is a bed of chalk of great thickness. In the north-west corner, near Saffron Walden, this chalk is at the ground surface. It dips, however, towards the south and east, and save at Purfleet and Grays where there is a large outcrop, it is nowhere seen at the surface. It gradually sinks deeper and deeper until, towards Southend, it is 600 feet below the ground level.

Above the chalk are series of layers of clayey sand and sand of no great thickness. These are only seen at the surface over a very limited area as they descend with the chalk. Upon these beds rests a layer of stiff clay (London Clay), which increases in thickness from near Dunmow to Southend, at the latter place being some 400 feet thick.

Over a large portion of central Essex, this clay is bare, that is, it is not covered with sand or gravel or any similar pervious material, hence on these areas water is very difficult to obtain as it is useless to sink shallow wells in clay. Fortunately, however, most of the London Clay is covered with a layer of gravel, sand, or brickearth, which, being pervious, retains a portion of the rainfall and yields it up again when wells are sunk to a sufficient depth, from 8 to 20, 30 or occasionally 40 feet. Over large areas again this sand is covered with a layer of Boulder Clay, in some cases 40 to 70 feet in thickness. This Boulder Clay is not nearly so impervious as the London Clay and it often yields a limited amount of water, but usually it is necessary to sink a well through it to the sand beneath from which more water is, as a rule, obtainable.

For water supply purposes, therefore, we can divide the county up into areas according to the nature of the subsoil :—

- (a.) Areas covered with water-bearing sand and gravels.
- (b.) Areas covered with Boulder Clay, yielding little water.
- (c.) Areas covered with London Clay, yielding no water,
- (d.) Areas of exposed chalk, yielding water freely.

We must remember, however, that practically everywhere throughout the county water can be obtained from the chalk if a boring of sufficient depth is made.

In all cases also a certain amount of water can be obtained from the roofs of houses, but, with the low rainfall which prevails in this county, the best collecting arrangement will not yield more than one gallon per person per day. From the roof of an average cottage the amount capable of collection will give a supply of five gallons per day. If properly collected, either by the use of a "rain water separator" or the use of a separator and filter, the water is well adapted for drinking and cooking, and frequently other sources are available for general slopping purposes. Fortunately this method of obtaining a supply is only necessary over limited areas, since in the Chelmsford, Maldon, and Rochford Rural Districts, most of the parishes on the London Clay, which were dependent upon rain water collected from roofs, and in ponds, &c., are now abundantly supplied with pure water from well constructed water works. In these districts there are some 50 miles of water mains. A brief description of the works is given in the section relating to those districts. Other such areas are supplied by various water companies.

Occasionally, where there are gravel beds on higher ground, it has been found possible, at a small expense, to pipe a spring water to supply a farm, or large house, or group of cottages. There are many places where springs are available and it is a pity that they are not more widely utilised. The parishes on the London Clay having a public water supply are :—

IN THE CHELMSFORD RURAL DISTRICT. East Hanningfield, Woodham Ferris, Rettendon with Battles Bridge, Runwell. The same waterworks also supply Danbury, Sandon, and Little Baddow, which are on a gravel subsoil.

IN THE MALDON RURAL DISTRICT. Woodham Mortimer, Hazeleigh, Purleigh, Latchingdon, Cold Norton, Stow Maries, Althorne, and North Fambridge.

IN THE ROCHFORD RURAL DISTRICT. South Benfleet, Rayleigh, Hadleigh, Hockley, Hawkwell, and Rochford.

From being the worst supplied parishes the above have become the best supplied within the county. Further particulars of the works, routes of mains, &c., will be found in the sections relating to each district.

Most of the area in Essex supplied by the Herts and Essex Water Co. is also on the London Clay and includes the parishes of Harlow, North Weald Bassett, Epping and Theydon Bois.

The South Essex Water Co. supplies a very large area (*vide* Map), some few of the parishes being on the London Clay, Aveley, Stifford, Hornchurch, and Warley. The Tendring Hundred Water Company's mains from Manningtree to Harwich, Walton, and Frinton also pass through and supply certain parishes on the same formation, Bradfield, Wix, Ramsey, Great Oakley, Thorpe, and Kirby (*vide* Map).

Many of the parishes on the London Clay are supplied from one or more wells provided and maintained by the sanitary authorities. In such cases persons living at a distance suffer considerable inconvenience, and frequently use ditch or pond water rather than carry the water from the source provided. In a few parishes there is not even a public well and water from the roofs or from ponds or brooks has to be utilised. These parishes are referred to later in the section relating to the requirements of the county.

There is no doubt that the site of most of the Essex villages has been determined by the presence of patches of water-bearing gravel, forming as it were, oases in the desert of clay. It is, therefore, possible in many instances to obtain water from wells in a village, whilst no water is obtainable beyond its boundaries, the village having extended to near the edge of the gravel bed.

There are several extensive areas of sand and gravel in the county, and these will absorb about one-third of the rain falling upon them. This water, which penetrates the subsoil, either eventually flows out at the edges of these patches as springs (which will become dry unless rain falls with sufficient frequency to keep up the supply of ground water), or if, from the contour of the impervious stratum below, the springs and outcrop are not at the lowest level of the water-bearing stratum, a certain amount of water will always be retained, forming, as it were, an underground reservoir. This subsoil water can be collected from the springs or by sinking wells.

The largest gravel patches in the county are near Colchester and Danbury. That near Colchester extends from Wivenhoe on the east to Copford on the west, and from Layer-de-la-Hay on the south to Colchester on the north, and has an area of something like 18 square miles.

There are several large springs at its edge, which may some day be utilized. It drains entirely into the River Colne. The Danbury gravel patch is bounded by the Chelmer to the north and extends to Bicknacre in the south, and from a little beyond Chelmsford on the west, to Maldon on the east. It has an area of over 30 square miles. Both sides of the hill drain into the Chelmer. There are numerous springs along its edge yielding from a few thousands to a hundred thousand gallons per day. Several of these are utilised for supplying a large number of parishes in the Chelmsford and Maldon districts, and will be referred to when describing the water supplies of those districts.

In this country subsoil water is generally looked upon with suspicion, on account of so much of the ground surface being under cultivation and often highly manured. The water yielded by wells sunk in this subsoil varies very much in character. Properly selected sites yield water of considerable purity, but highly manured gardens, defective cesspools, sewers, &c., may so pollute the water in the subsoil in the immediate neighbourhood that wells in such localities must be considered dangerous.

In selecting a site for a well the above facts should be borne in mind, since in many cases it is possible to obtain a much better water at one side of a gravel patch, or even at one side of a house, than at another.

In the Boulder Clay districts water in limited amounts is often obtained by sinking through this clay into the thin bed of sand found between the Boulder Clay and the London Clay. This water is rarely of good quality. It is usually excessively hard, and in many instances such wells have been abandoned on account of the water having an odour of rotten eggs. This is due to the presence of a trace of sulphuretted hydrogen, but how it is formed is difficult to explain. The smell rapidly

disappears if the water is exposed in an open vessel. The odour, when the water is freshly drawn, is so disgusting that people naturally will not use it. Upon analysis such waters are usually found free from any trace of sewage contamination. I recently examined a Boulder Clay water from a well sunk in Great Waltham. The odour of rotten eggs was very strong and the people said that when they used it, it caused nausea and diarrhœa. There were no signs of any impurity save a trace of sulphuretted hydrogen.

The Bagshot sands occurring at Billericay, Fryerning, Stock, Galleywood, Hockley, Kelvedon Hatch, Brentwood, Rayleigh, and Hadleigh yield water freely. This sand is usually found capping elevated ground, and is so porous that the water gets away easily. For this reason the springs are numerous and small. At Billericay for example there are springs all round the town yielding water, which, if it could be collected at one point, would be abundant for the supply of the town. It cannot be so collected at a reasonable cost, hence nearly the whole is wasted.

The water from this sand is usually soft, but it often acts upon lead and galvanised iron, and several cases of poisoning from the lead and of trouble arising from zinc dissolved in the water have come under my notice.

Water obtained from any of the above-named sources by means of wells is quite wholesome, provided the site of the well has been properly selected and the well itself satisfactorily constructed. In many cases, even where the population is very scattered, the wells are situated too near the drains, cesspits, or cesspools, and in most cases the wells are of very imperfect construction. Hence the frequency with which waters from such sources are found upon analysis to be so impure as to be declared unfit for domestic

use. Unfortunately perfectly wholesome waters are frequently condemned. Analysts rarely make a special study of the effect of waters of diverse characters upon health, having neither the opportunity nor the necessary medical qualifications for making such investigations. Consequently certain empirical standards are set up and if a water contains less than a certain amount of chlorides, nitrates, ammonia, &c., it is passed as good, and if it contains more than this quantity it is condemned. A water condemned as polluted by this method would, if diluted with a proportion of clean rain water have its chlorides, &c. sufficiently reduced, to be passed as a pure water, which is absurd. Moreover, the evidence of experience is entirely ignored. The waters which have caused the most serious outbreaks of Typhoid Fever have not contained excessive amounts of the above-mentioned substances which are in themselves harmless, but have been waters which chemically were passed as pure or good or wholesome.

Educated as we all are to believe that shallow well waters are sure to give rise to Typhoid Fever it is somewhat startling to find that in our Rural Districts cases of Typhoid Fever are so rare, and that those which do occur are seldom attributed to pollution of the local water supplies (I am speaking now of well water only and not of water from brooks or ditches). Of those attributed to the use of well water the proof is in most cases utterly inconclusive. I am becoming more and more convinced as the result of my personal observations and my study of the distribution of Typhoid Fever that this disease is never caused by well water when the well is so constructed that no impurity can get into it without having filtered through 8 or 10 feet of soil. The purifying effect of soil is well known and though it may fail to remove the last trace of ammonia or organic matter from

the water and though it adds a considerable quantity of chlorides and nitrates which are in themselves absolutely harmless, it apparently renders it quite safe for drinking purposes. The wholesale condemnation of well waters is in my opinion entirely unjustifiable and has done very great harm by prejudicing people against residence in the country where well water only is obtainable. If well water were so dangerous as is so widely taught, Typhoid Fever ought to be far more prevalent in rural areas where people use well water largely than in large towns with public water supplies, but such is not the case. Take Essex as an example :—In the Urban Districts the average number of attacks of Typhoid Fever per 1,000 population per annum during the past 14 years has been 1·3. Whereas in the Rural Districts it was only ·8. Therefore, in proportion to the population, 50 per cent. more cases of Typhoid Fever occurred in the towns with public water supplies than in the villages and country places using well water chiefly.

This subject is one of the very highest importance not only to Essex but to the country generally. The experience of all Rural Medical Officers of Health confirms these statistics and proves that well waters containing so much organic or other matter that many analysts unreservedly reject them as being dangerous to health, are perfectly wholesome, and can be used with less risk than the public supplies to large towns.

This argument does not apply to brook waters and pond waters. All the rural outbreaks which I have investigated have arisen from the use of waters which have not filtered through the ground. The polluting matter has directly entered the brook or spring or in a few cases has run directly into an open well. I have never traced a case of Typhoid Fever to the use of water from a properly

covered and constructed well, even when such wells have been so near cesspits, cesspools or highly manured land that the water contained large quantities of the chlorides, nitrates, and other products of the oxidation of such matters.

No person need, therefore, hesitate about taking up his residence in the country merely because he will have to use well water for drinking and domestic purposes. With a properly constructed well he may feel decidedly safer, so far as water borne disease is concerned, than in drinking the Thames and Lea water in London, or the moorland waters supplied to Manchester, Liverpool and other cities.

Whilst well water may be perfectly safe, though not organically pure, river, brook, and pond waters can rarely be considered safe, however pure they may prove to be upon analysis. The former is protected from dangerous pollution by the earth in which it is sunk, whilst the latter are entirely unprotected and may at any time become contaminated. It is the water from these streams, &c., which is responsible for most of the water-borne disease which occurs. Protection of the streams so as to ensure their safety as sources of water supply is quite out of the question. If actual sewage or sewage effluent does not gain excess, every rainfall washes in manurial matter from gardens, fields, &c. Cattle, dogs, &c., lave therein and tramps utilize them for bathing and clothes washing purposes. From time to time also privies may be found projecting over the edges or cesspits, and cesspools may leak into the stream. Slops may also be thrown in or into communicating ditches, hence the use of such water for domestic purposes is always fraught with danger, and the smaller the stream the greater the danger. On the large scale the dangerous polluting matter may be removed by filtration if not too

abundant, but domestic filtration cannot be relied upon. If such a water must be used it should always be previously boiled, and then passed through a Pasteur or Berkfield filter.

In the north-west of the county, round Safron Walden, water can be obtained from shallow wells sunk in the chalk. This water is usually very hard, but otherwise of excellent quality. It must, however, be remembered that chalk wells are far more liable to pollution than wells sunk in gravel and sand as the water chiefly travels through fissures in the chalk and polluting matter entering a fissure from a drain, cesspit, or cesspool may travel a long distance without undergoing any purifying process such as takes place in travelling through sand, and may finally reach a well.

As previously stated the whole of the County is underlaid by a bed of chalk several hundreds of feet in thickness, and between this and the London clay there are beds of sand and sandy clay, these beds in some places being over 100 feet thick, but the variation is considerable. Water is obtainable from these sands, and in every case which I have investigated, the water is identical with that obtained from the chalk lying beneath. That this must be the case will be obvious upon reflection. There is no bed of clay or other impervious material between the chalk and the sands, hence water rising in the chalk must pass into the sand, the whole forming one porous water-bearing stratum.

The outcrop of the sand has a very limited area indeed, hence little water is collected by it, and such as is collected probably passes downwards and mixes with that in the chalk. The chalk outcrop is very extensive extending in a south-westerly direction from Ipswich to Salisbury Plain, and then in an easterly direction from

Salisbury to Dover. The width of this outcrop often exceeds 20 miles. All this area is absorbing a certain portion of the rainfall, some of which it transmits directly into the sea, some into the rivers, and an unknown quantity travels eastwards and downwards through the chalk where this passes under the London Clay. Where the chalk outcrops under the sea (if such outcrop occurs) or under the Thames (as is known to be the case), doubtless the water finds an outlet as the flow must be from the high level collecting areas towards these lower points. Where the water gets out under the surface of the sea, or a tidal river, it is obvious that water can get in if for any reason, such as excessive pumping, the level of the water in the chalk be depressed below that of the sea or river. This has frequently occurred near the coast and near the Thames.

The chalk outcrop in this county is very limited in area, and probably most of the water it collects flows southward into the Lea Valley, or northwards into the valley of the Cam. In the latter case it is lost to the county.

For further details concerning the chalk as a water-bearing stratum my large Report on Essex Water Supplies may be consulted. The water from the chalk where it is covered by the London Clay is usually of the highest degree of organic purity, but near the coast the deep wells are liable to the infiltration of tidal water rendering the whole supply brackish. This deep chalk water in central and south-east Essex is peculiar inasmuch as it is usually very soft and in this respect quite unlike chalk waters generally. Water is obtainable in a moderate amount, from the chalk in any part of Essex by sinking a well or by boring where the chalk lies deep beneath the surface. The cost of boring varies with the depth

and diameter of the bore. Where the depth does not exceed 300 feet a boring may cost about £1 per foot, but it will average more if this depth is exceeded. A deep well source is out of the question for a supply of water for one or two cottages, but for a group of cottages, mansion, farm, or public institution the cost is often very reasonable. Some of our parishes now deriving water in very limited amount from objectionable sources might be supplied by a deep well if the Sanitary Authorities would only incur the expense. It would be still better, and probably in the end more economical, to make one deep well supply several parishes, as has been done by the Rochford Rural District Council. In many instances springs might be utilised for supplying such parishes as it is often cheaper to pipe water a few miles and supply the water by gravitation than to sink a deep well and construct and maintain a pumping plant.

Unfortunately for rural areas, these village supplies require more skill and thought to devise than supplies to large towns, hence engineers of repute do not care to be troubled with them. Members of Sanitary Authorities and their officers who wish to see what can be done in the way of supplying groups of parishes cannot do better than study the schemes which have been carried out by the Maldon, Chelmsford, and Rochford Rural District Councils. I am convinced that there are several portions of this county which could be supplied in a similar way and with great advantage to all concerned. For dairy-farming purposes an abundance of good water is an absolute necessity and no considerable increase of population can take place without the provision of a public water supply.

Not only do the occupiers benefit but land and property increase in value. This increase is probably in all

cases more than the cost of the water undertaking and it is a pity that owners do not realise this and assist the Authorities in providing supplies. I remember that soon after the Maldon Rural Works were completed a gentleman told me that he held certain house property which was often unlet for long periods at a time and which he could not sell on account of there being no water supply, but that immediately the water was laid on he sold the property at a very satisfactory price. In the adjoining district an estate which had for some time failed to find a purchaser, sold readily and at a good price when the water mains were laid through it.

In describing in more detail the water supplies in the rural portions of the county I propose treating each rural district separately commencing with those in the southern part of the county. The maps appended are reproduced from the larger report issued in 1901 and where any known extensions of water mains have been made these are referred to in the text. I have given the names of the Clerk and Medical Officer of Health for each district so that applications may be made to them if further information is required, and I have to express my thanks to the Medical Officers of Health for revising and correcting my notes on the water supplies of their respective districts. In some cases also the Sanitary Inspectors have furnished me with valuable information.

THE ROMFORD RURAL DISTRICT.

Medical Officer of Health—DR. A. WRIGHT, Romford.

Clerk—R. SMITH, Esq., Romford.

This district comprises the parishes of Cranham, Dagenham, Great Warley, Havering, Hornchurch, Rainham, Upminster, and Wennington, with a population of about 20,000 at the present time.

The mains of the South Essex Water Co. ramify in every parish, save one, through the centres of population so that all may be said to be supplied from this source, but in every parish there are areas not supplied from the mains simply because it would not at present or in the immediate future pay the Water Co. to make the necessary extensions.

CRANHAM (population 397) is on brickearth and London Clay. Most of the houses are supplied from the mains and as water is not obtainable on the clay, some few of the inhabitants have to go a long distance for water.

DAGENHAM (population 6,091) is a very extensive parish standing on alluvium, gravel, and London Clay. About 500 of the population derive water from wells, said to be of wholesome quality, the remainder are supplied by the Water Co.

GREAT WARLEY (population 1,900) is on London clay. The northern portion of the parish is supplied by mains. There are probably a few pockets of gravel as some 40 houses derive water from shallow wells but there are others which depend for their supply upon ponds and what is collected from the roofs.

HAVERING (population 407) is on the London Clay. The population is scattered and only a few houses are connected with the mains. There is a public well which yields but a limited supply of water. When this fails ponds have to be resorted to.

HORNCHURCH (population 6,402). The northern portion of the parish is on London Clay, the larger and southern portion on brickearth and alluvium. Practically all the houses are supplied by the South Essex Water Co.



SOUTH ESSEX WATER CO

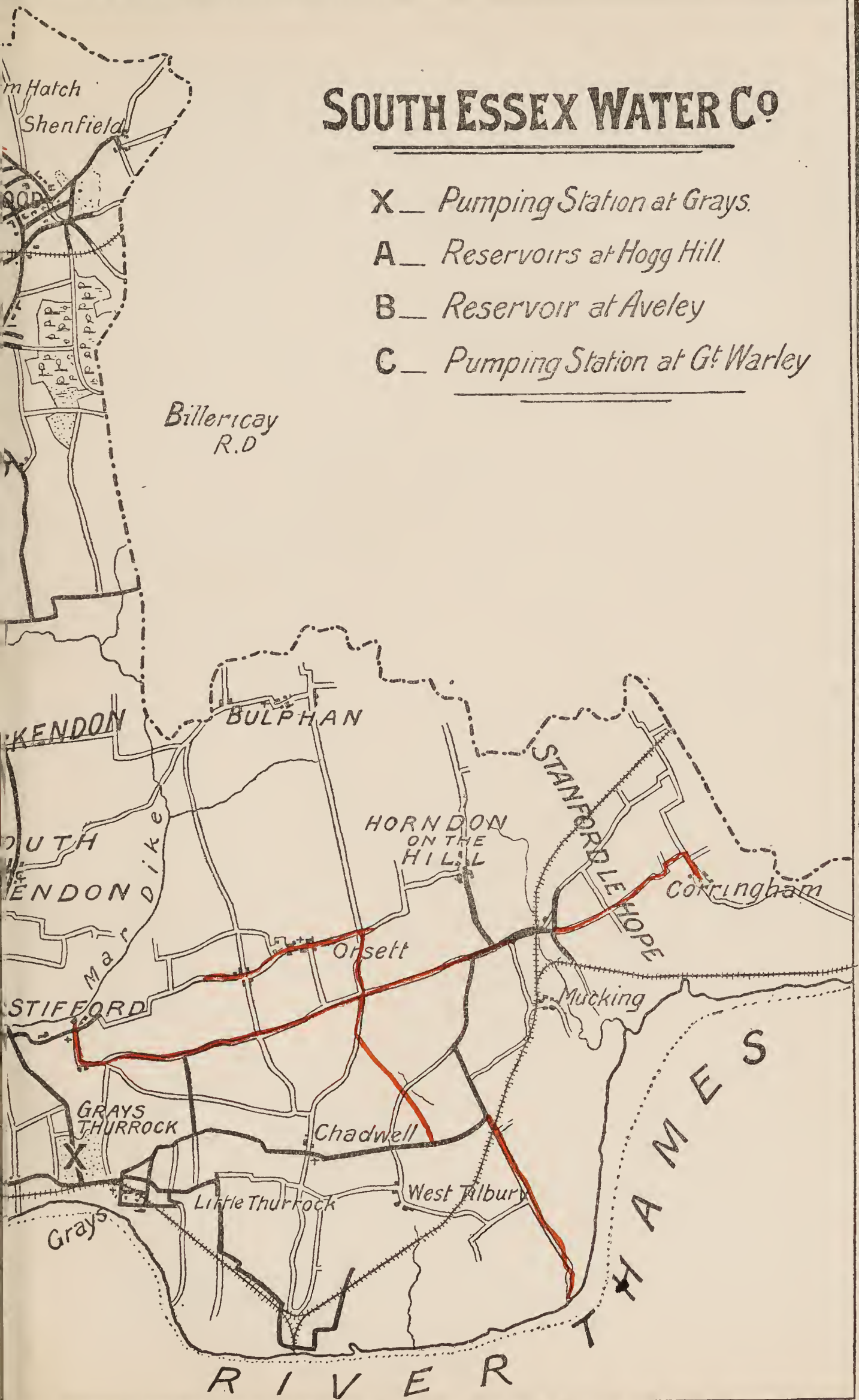
X_ *Pumping Station at Grays.*

A_ *Reservoirs at Hogg Hill.*

B_ *Reservoir at Aveley*

C_ *Pumping Station at Gt Warley*

*Billericaay
R.D*



RAINHAM (population 1,725) is on gravel and alluvium, and save a few houses which are still supplied from wells, all have water laid on from the mains.

UPMINSTER (population 1,477) is on brickearth and gravel. Two springs supply a few houses on the common, but practically all the parish is supplied from the mains.

WENNINGTON (population 360) on gravel and alluvium. There are few wells, most of the houses being supplied from the mains.

NOAK HILL (population 259) on London Clay. This small outlying parish is some distance from the South Essex water mains, and the inhabitants depend upon one private well for water. The supply is obviously inadequate.

The Medical Officer of Health is at present engaged in examining the waters from private wells, and so far finds all of satisfactory quality. It must be remembered that the Sanitary Authority has no power to compel the owner of any house to lay on water from the public mains if the house has a supply from a well or other source which the Medical Officer of Health deems satisfactory.

Taking this district as a whole, it may be said to be adequately supplied with water. The water of the South Essex Company is somewhat hard, but otherwise of unobjectionable quality. The appended map shows the distribution of the Company's mains.

THE ORSETT RURAL DISTRICT.

Medical Officer of Health—DR. REA CORBETT, Orsett.

Clerk—J. BECK, Esq., 2, Orsett Road, Grays.

This district comprises 17 parishes with a population a little over 20,000. The following particulars with reference to the geological features of the district and the water supply are taken from Dr. Corbett's report for 1903,

supplemented by more recent information kindly furnished by him and by the Water Companies.

The geological formation underlying the district is chalk, which crops out at Grays and Stifford. Thanet sands occur on the uplands of Aveley, Grays, Little Thurrock, Chadwell-St.-Mary, and West Tilbury. Woolwich beds at parts of Orsett, South Horndon-on-the-Hill (Pump Street), and North Stanford-le-Hope. London clay crops out at Bulphan and the adjoining parts of Orsett, Horndon-on-the-Hill and Laindon Hill, Corringham and Fobbing. Patches of Bagshot beds occur at Laindon Hills (the top) and Dry Street, Fobbing; brick earth and gravel at various places; alluvial deposit on the whole south border of the district and the greater part of eastern boundary, and at Orsett and Bulphan Fens.

The district is for the most part flat and low. The only hill of importance is Laindon Hills (in the north-east), 385ft. high.

The chief supply of water to the district is derived from the South Essex Water Company. The mains supply Tilbury Docks, Little Thurrock, West Thurrock, Stifford, Aveley, South and North Ockendon, Stanford-le-Hope, and Horndon-on-the-Hill. The wells are situated one at Grays in the chalk pits, and one (recently purchased) at Linford, Mucking, supplying Stanford-le-Hope and having mains laid to Horndon-on-the-Hill and also along the road from Linford to Grays, connecting with Grays near the cemetery. The mains laid to Horndon-on-the-Hill for the last year and a half are now supplied with water from Linford well. At Linford a second large well has been dug down into the chalk, and there is an abundance of good water in it. Pumps, &c., are now fixed, and a main laid from it across Mucking Heath to come out into the high road at the junction of the road from Orsett to

Chadwell-St.-Mary with the road leading from Stanford-le-Hope to Grays, at Orsett Cock, passing then along the county road, and *via* Stifford Long Lane to the company's reservoir at Aveley. The water level in the district has been getting lower for the last few years, and at Orsett, although many wells have been lowered, there is a scarcity of water, and negotiations with the South Essex Water Company for a supply have been going on for over a year, with the result that mains have now been laid connecting with the main near "Red Lion" Farm, on the Stanford-le-Hope road, going thence to Orsett Cock and then down the road past Barringtons to Orsett Hall and up through Orsett Street to Orsett Rectory gate, then through the village of Orsett up to the Union House, the Schools, and Mill House—then from Orsett Street along the road to Baker Street and Stifford Road, and on the Grays Road as far as Chapel Farm. Bulphan and the lower parts of South and North Ockendon are supplied from artesian wells, about 100ft. deep, many of them flowing above the surface of the ground. Corringham and Fobbing were supplied by a very superficial wells, and here a considerable amount of building is going on, and it was essential that a better supply of water be obtained. A main has now been laid from Stanford-le-Hope to Digby Road, Corringham. The Southend-on-Sea Water Company have a well in Fobbing and have an agreement with the Orsett Rural District Council to supply water in this parish at a charge of 1s. 6d. per 1,000 gallons; it would be well to have mains laid down and a supply obtained from this source. An agreement has now been made with the Southend Water Works Company to lay a main and supply the village of Fobbing. Laindon Hills is badly supplied with water, Dry Street, to the east, obtaining its supply from a spring in a pool at Well Green, which is liable to

pollution from surface water. A spring half-way down the West Hill has been enclosed and domed over and gives a constant supply of good water. To the north of Laindon Hills, there is a considerable amount of building going on, and application has been made for water certificates, the supply being rain water, caught from the roofs of the houses. I have advised the Council that the rainfall in South Essex is not large enough to make it certain that enough water will be able to be collected from the roof of an ordinary house to give a constant supply for an ordinary family. The Council has consequently, at present, refused to grant certificates. Just lately two wells have been dug which appear to give a good supply and will prove to be of good quality. The source of the water is the cap of bagshot beds on the top of the hill.

WEST THURROCK. Population about 3,000. 95 per cent. of houses supplied from the mains, the remainder by private wells.

LITTLE THURROCK. Population 2,460. 95 per cent. supplied from mains, 5 per cent. from wells.

CHADWELL (Lower Ward). Population 4,762, is supplied entirely from the mains.

CHADWELL (Upper Ward) AND WEST TILBURY. Population about 1,000. Only 5 per cent. supplied from mains. 90 per cent. are supplied by private wells and remainder by a public well at foot of Chadwell Hill. The wells are about 70 feet deep. The South Essex main passes through and houses can connect therewith. The well waters being at present satisfactory, the Authority cannot compel the connections to be made.

EAST TILBURY. Population 464. All the houses are supplied from wells which average 60 feet in depth. The water main runs through the village but no houses have at present been connected.

MUCKING. Population 494. 75 per cent. are supplied from the mains, the remainder from private wells, which vary from 20 to 70 feet in depth.

STANFORD-LE-HOPE. Population 2,030. 95 per cent. of the houses supplied from the mains, remainder from shallow wells, 8 to 40 feet in depth.

FOBBING. Population 460. 10 per cent. supplied from mains, 75 per cent. from private wells. There are two public wells, one about 12 feet and the other 60 feet deep. The supply is not sufficient and the Sanitary Authority has applied to the Local Government Board for permission to borrow money to lay down mains to supply the village from the Southend Water Co.'s works.

CORRINGHAM. Population 860. 75 per cent. supplied from the mains, 15 per cent. from private wells. There is one public well about 50 feet deep.

LAINDON HILLS. Population 400. This is the most elevated part of the district and the worst supplied with water. 35 per cent. are supplied from springs, 30 per cent. from shallow wells and the remainder depend upon rain water collection. The Sanitary Authority is negotiating with both the South Essex and Southend Companies for a supply to the portion of the parish near Laindon Station where building is going on.

AVELEY. Population 1,130. 95 per cent. supplied from the mains, the remainder from private wells.

STIFFORD. Population 1,075. South Stifford is entirely supplied by the mains and about 90 per cent. of the houses in North Stifford. The remainder are supplied by private wells, 40 to 60 feet in depth.

HORNDON-ON-THE-HILL. Population 718. Although the water mains run through the village only 50 per cent. of the houses are connected. 15 per cent. have private

wells and the remainder depend on the public pump. The wells vary from 12 to 180 feet in depth.

BULPHAN. Population 349. All supplied from bored wells averaging a little over 100 feet in depth. Some of the wells yield a soft water, others a hard water, and a few of the bores overflow.

NORTH OCKENDON. Population 340. 80 per cent. supplied from the mains, about 15 per cent. from the public pump and remainder from private wells, 25 to 35 feet in depth.

SOUTH OCKENDON. Population 1,142. 95 per cent. supplied from the mains, remainder from private wells about 25 feet deep.

ORSETT. Population 1,326. Only 10 per cent. of the houses are connected with the mains, nearly all the others have private wells. A few people utilize a spring in Baker Street. The majority of the wells are about 30 feet deep, but some are over 100 feet. Should these wells show signs of failure the Authority would insist upon the houses being connected with the mains.

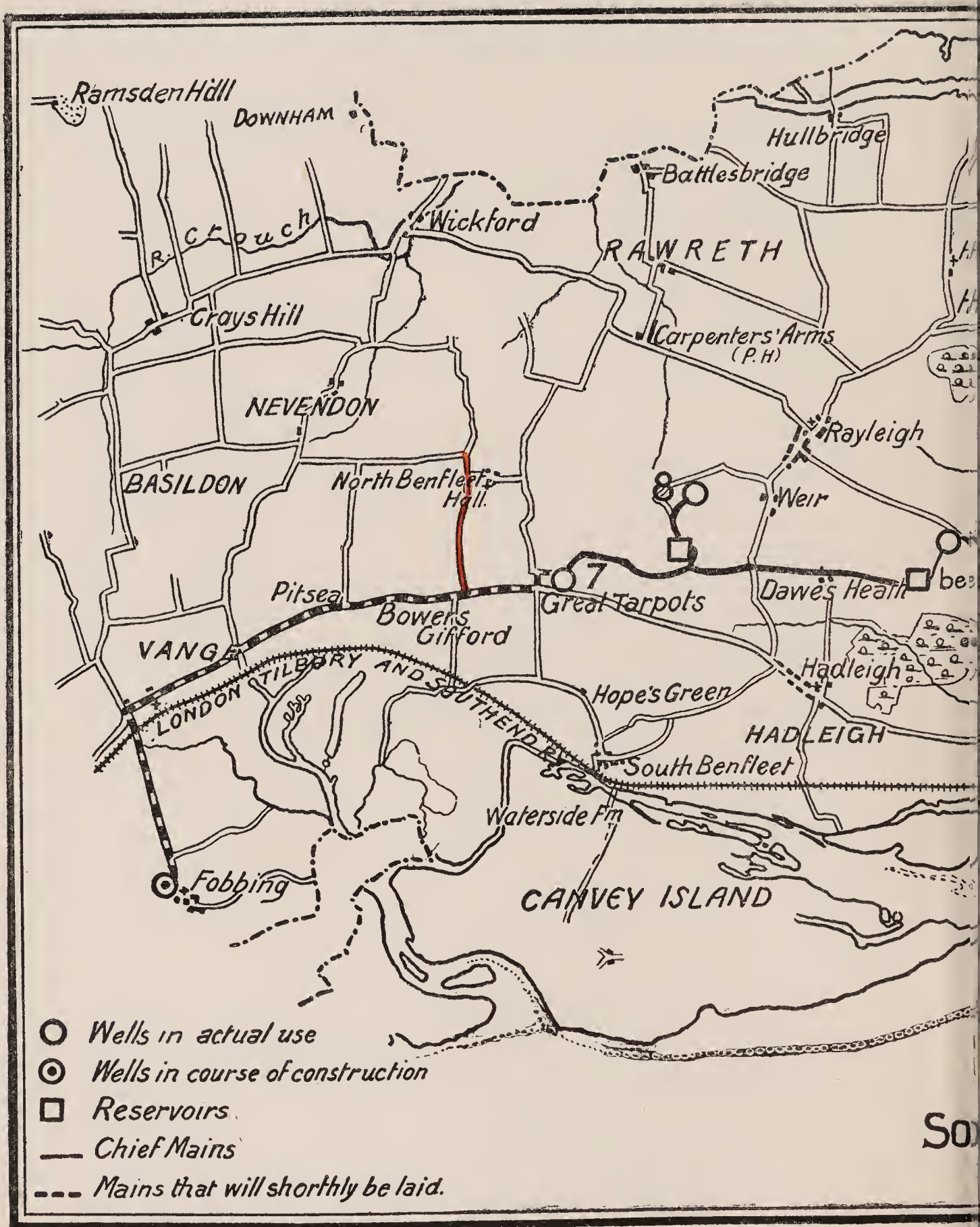
From the above description it is obvious that with one or two exceptions the various parishes are well supplied with water. The routes of the various water mains are shewn on the maps of the South Essex and Southend Water Co.'s areas of supply. Extensions made since 1901 are described above in Dr. Corbett's report.

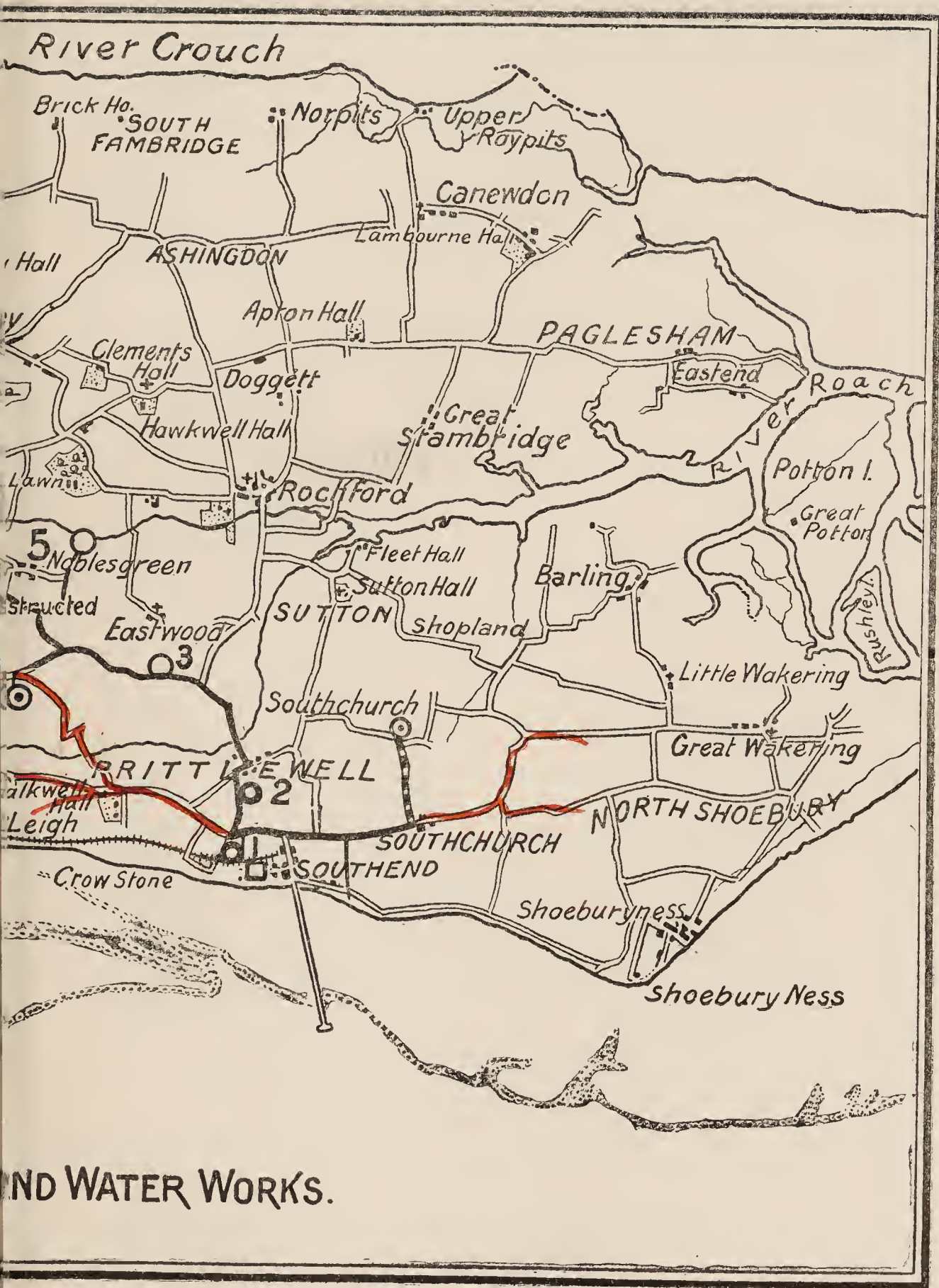
THE ROCHFORD RURAL DISTRICT.

Medical Officer of Health—DR. F. D. GRAYSON, Rayleigh.

Clerk—F. GREGSON, Esq., Southend-on-Sea.

This extensive district lies between the Rivers Crouch and Thames and is bounded by the sea to the east. Its area is 55,386 acres and it comprises 23 parishes with a





population of 14,565. A large portion of the district is on the bare London Clay and great difficulties have been experienced in obtaining water in many parishes. In consequence of this difficulty the Rural District Council undertook and has successfully completed a scheme for supplying several of the larger parishes which experienced the most difficulty in obtaining water locally. The Southend Water Co.'s mains also pass through the district and in fact derive water from several deep wells within the area and recently their mains have been extended to supply certain localities.

THE BENFLEET WATERWORKS. These works supply the following parishes :—

South Benfleet	...	Population	1,024
Hadleigh	...	„	1,343
Hawkeswell	...	„	326
Rayleigh	...	„	1,773
Rochford	...	„	1,829
Thundersley	...	„	809

Water is derived from a deep well sunk into the chalk at South Benfleet and is pumped into an elevated reservoir from which it flows to supply the parishes named. The Medical Officer of Health estimates that three-fourths of the population of these parishes are now supplied with water from the public mains, three-sixteenths by water from private wells, and one-sixteenth still depend upon rain water collected from roofs, etc. The District Council contemplates further ramification of the mains to supply a larger proportion of the population. Doubtless this excellent water supply will greatly help the development of the district.

ASHINGDON, population 178, subsoil clay. There are deep wells at the Hall and at Hill Farm. Most other houses depend upon rain water.

BARLING, population 336, subsoil gravel and clay. The supply is limited and derived from shallow wells.

CANEWDON, population 495, subsoil clay. There is a public well (deep) which supplies most of the parish. There is one private deep well and several shallow wells.

CANVEY ISLAND, population 307, subsoil alluvium. There is one public and one private deep well. A shallow well supplies the Coastguard station. Many houses depend upon what is collected in rain water tanks.

EASTWOOD, population 709, subsoil gravel and clay. The Southend Waterworks supply many houses, the remainder depend upon shallow wells.

FAMBRIDGE, SOUTH, population 166, subsoil clay. At the Ironworks here a deep well has been bored and from this nearly the whole population is supplied.

FOULNESS ISLAND, population 537, subsoil alluvium, clay, and sand. There is a deep well at nearly every farm, but the yield of water is in all cases limited.

HOCKLEY, population 905, subsoil loam. There is one deep well yielding a limited supply and several shallow wells. The supply is not satisfactory.

PAGLESHAM, population 456, subsoil gravel. Water is easily obtained from shallow wells.

RAWRETH, population 365, subsoil heavy loam. There is a bored well at Burrell's Farm yielding a good supply, but most of the houses depend upon shallow wells and some upon rain water tanks.

SHOEBURY, NORTH, population 205, subsoil alluvium. Supplied from shallow wells.

SHOPLAND, population 54, subsoil gravel. Each farm is supplied from a private shallow well.

STAMBRIDGE, GREAT, population 331, subsoil clay and gravel. There is a public well in Great Stambridge.

STAMBRIDGE, LITTLE, population 117. Private wells (shallow) supply most of the population.

SUTTON, population 194, subsoil gravel. Water is easily obtainable from shallow wells.

WAKERING, GREAT, population 1,820, WAKERING, LITTLE, population 277. Subsoil gravelly. Water is freely obtainable over most of this area, but near the centres of population the water is not of good quality. There is one deep well here yielding an excellent water. The Rural District Council have for some time been considering the possibility of obtaining a supply for Great Wakering.

This is a district which may be expected to develop considerably in the near future and it is to be hoped that the success of the first public scheme of water supply will encourage the Rural District Council to group other parishes and provide supplies of a similar character.

THE EPPING RURAL DISTRICT.

Medical Officer of Health—Dr. TREVOR FOWLER, Epping.

Clerk—R. D. TROTTER, Esq., Epping.

This district comprises 16 parishes with a population of 12,780, and includes most of Epping Forest. The whole district is on London Clay, which is either exposed or covered with Boulder Clay; here and there, however, there are thin cappings of sand or loam. Over much of the area water is difficult to obtain, but fortunately the water mains of the Essex and Herts Water Co. ramify through many of the parishes, and yield a fairly abundant supply of good water. The surface is elevated and undulating, rising to about 380 feet above O.D., near Epping, and it is particularly well wooded. The rainfall here is higher than in Essex generally. There are

numerous streamlets, those on the east flowing into the River Roding, and those on the west into the Lea. Deep wells in this district do not appear to yield water very freely, and they are comparatively few in number.

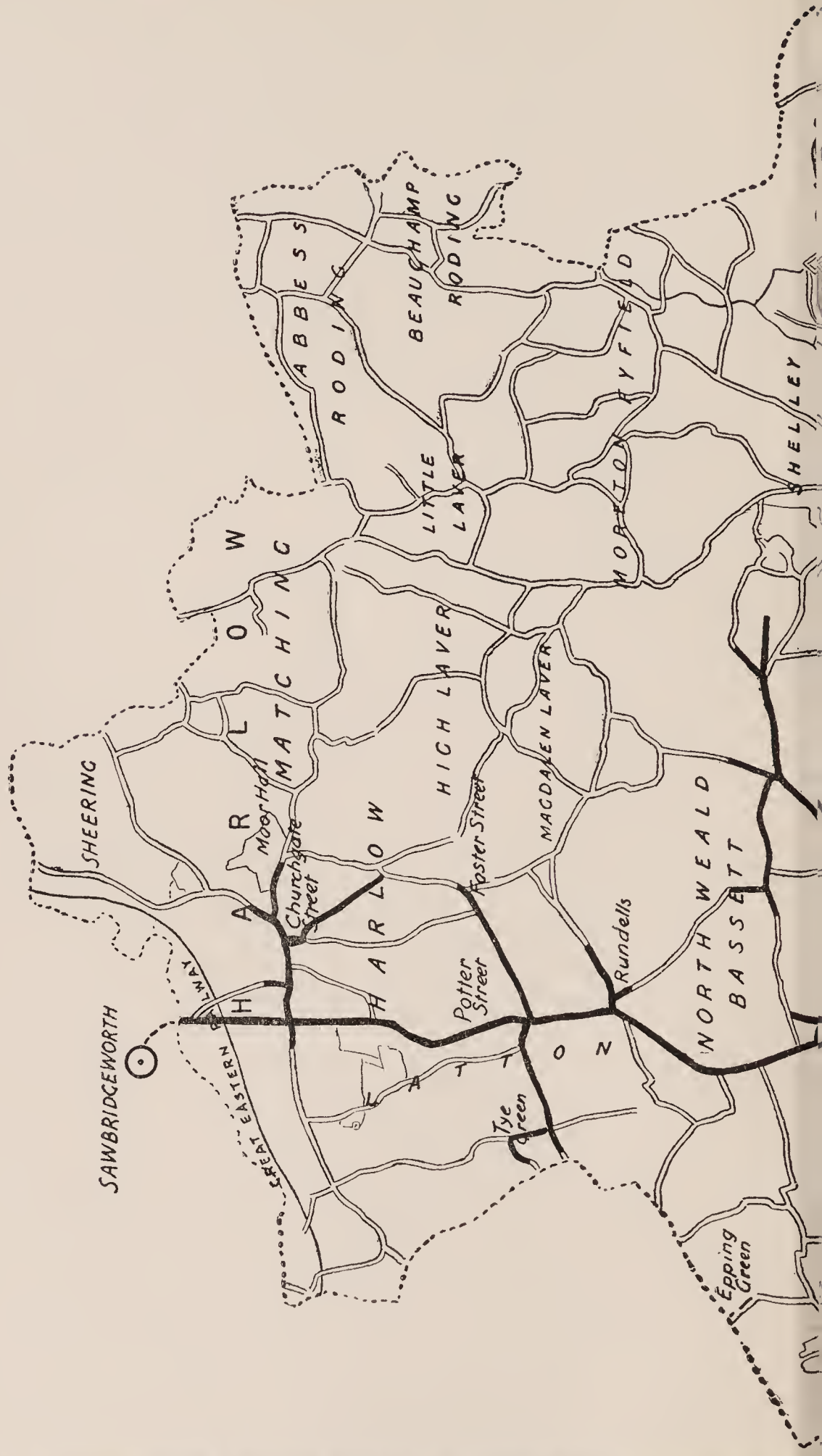
The distribution of the Herts and Essex Co.'s mains is shown on the accompanying map, which includes both the Epping and Ongar Rural Districts. Since this map was prepared, the mains have been extended from Abridge to connect with the mains of the Metropolitan Water Board (East London system), so that the supply may be supplemented therefrom whenever necessary. The Company has power to supply all the parishes shown on the map, but at present their mains only extend into about one-third of the total.

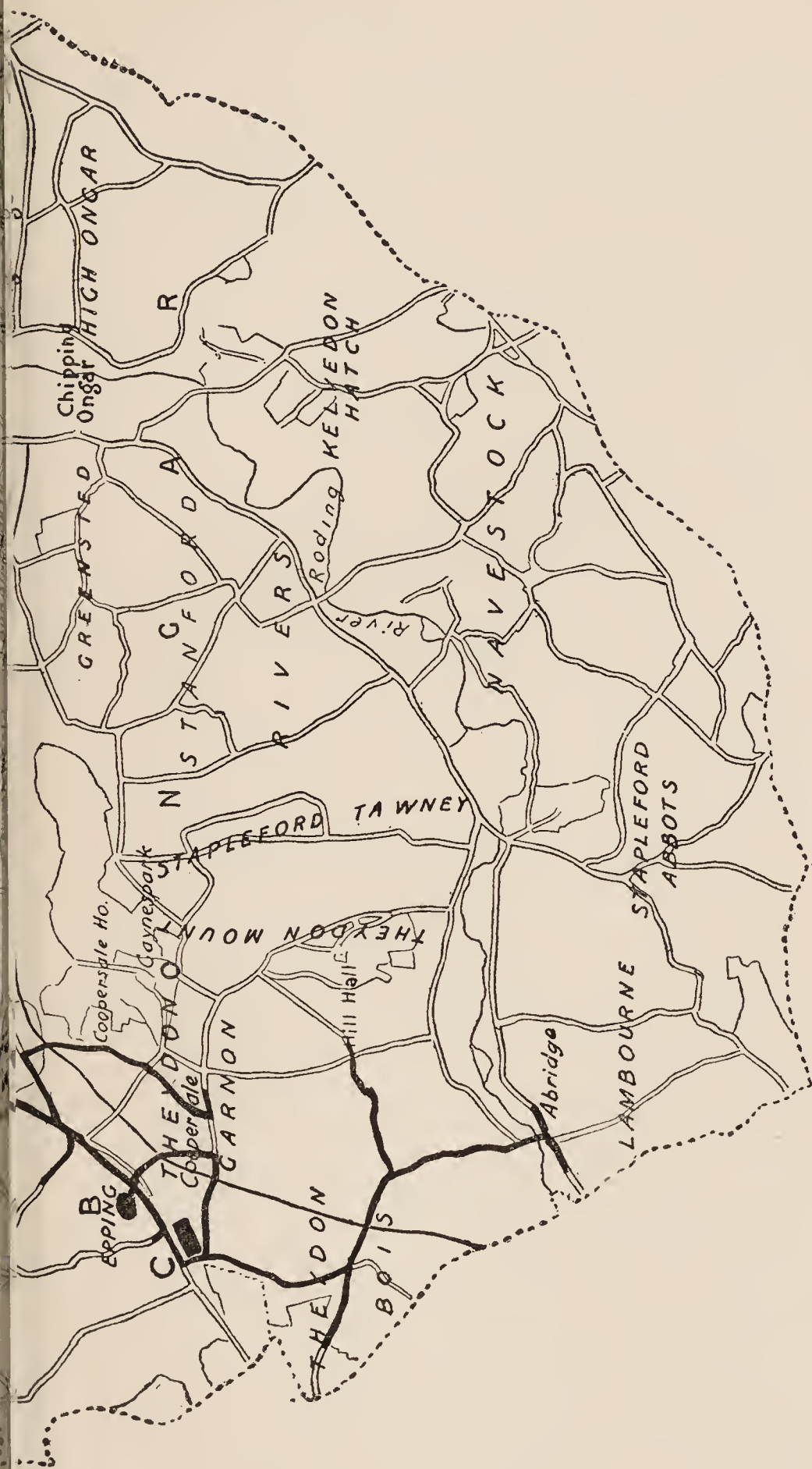
The trunk main passes through Harlow near its western border, and branches supply the village. After passing along Potter Street, branches are given off east and west, the latter into Netteswell parish. It then closely follows the boundaries of Latton and North Weald Bassett parishes, giving off a long branch in the latter parish, which extends into the Ongar district. The trunk main then traverses Epping Town to a reservoir near the Bell Inn, and from here it proceeds through Theydon Bois to its termination at Abridge, giving off a few branches along its course, one of which ends near Theydon Garnon Church. In the Epping Rural District the Company supplies a population of about 6,000, leaving about half to be supplied from other sources.

PARISHES SUPPLIED BY THE ESSEX AND HERTS WATER Co.

Epping Upland	...	Population	744
Harlow	...	„	2,619
Netteswell	...	„	593

HERTS AND ESSEX WATER COMPANY'S DISTRICT





MAP SHOWING LINES OF WATER MAINS

A = Wells and pumping station at Sawbridgeworth

B = Water tower and C = Reservoir at Epping

North Weald	...	Population 1,135
Theydon Bois	...	„ 937
Theydon Garnon	...	„ 305

In all these parishes there are outlying portions supplied by wells. Very few houses are entirely dependent upon rain water.

CHIGWELL, pop. 2,509, is supplied by the East London section of the Metropolitan water supply.

PARISHES NOT DERIVING WATER FROM THE ABOVE
SOURCES.

LATTON, pop. 226, and MAGDALEN LAVER, pop. 148, depend upon shallow wells.

MATCHING, pop. 562, has two or more public wells, but most of the parish is supplied from private wells.

NAZEING, pop. 795, has both public and private wells, but some parts have a difficulty in obtaining water, as the Rural District Council recently constructed a filtering arrangement for purifying pond water.

GREAT PARNDON, pop. 529, LITTLE PARNDON, pop. 93, ROYDON, pop. 1,005, and SHEERING, pop. 584, are supplied from public and private wells. There are a few deep wells. Only in remote areas have ponds and ditches to be resorted to. It is obvious that a further extension of water mains is desirable in this district, but apparently the centres of population are so small and scattered that it would not pay the Water Co. to make such extensions unless they were subsidised by the Rural District Council out of the rates. The water supplied is said to be “hard,” and to frequently contain a trace of iron, rendering it objectionable. The supply also is “intermittent,” and unless each house provides a storage cistern, it is without water for a portion of each day.

THE BILLERICAY RURAL DISTRICT.

Medical Officer of Health—Dr. F. CARTER, Billericay.

Clerk—C. E. LEWIS, Esq., Brentwood.

This important district has a population of 18,000 on an area of 49,200 acres in 24 parishes. It is very undulating, and comprises many areas which sooner or later must become residential. There are patches of sand and gravel in Great Burstead parish, in which the town of Billericay is situated, but the remainder of the area is almost bare London Clay. A few springs arise round Billericay, but they are too small to serve as public supplies. Water in any quantity is only obtainable from deep wells, and the great expense of sinking wells here sufficiently deep and large to serve any large area has hitherto tended greatly to prevent development, but the Billericay Rural District Council are now carrying out a scheme which will supply a number of parishes, and they have also arranged with the Southend Water Co. for the supply of others. In a short time when these undertakings are completed, the condition of the district, so far as water supplies are concerned, will have undergone a very great improvement. The South Essex Water Co. also have mains in this district.

THE BILLERICAY WATERWORKS. At present Billericay is supplied by numerous shallow wells, springs supply many other houses in Great Burstead parish, but the water is very unsatisfactory, either in quality or in quantity. A scheme has been approved by the L.G.B. for supplying—

Billericay and Burstead	Population	1,870
Hutton ... ..	...	629
Ramsden Crays ...	...	201
Ramsden Bellhouse	...	396
Laindon ... ..	...	417

Basildon	...	...	Population 307
Nevendon	...	...	„ 166
Downham	...	...	„ 258

All these parishes are very badly in need of a water supply. Deep wells of small diameter supply a limited number of houses in the vicinity of each, but a great many houses have to depend upon ponds or water collected from the roofs or cart water from considerable distances.

The new scheme will supply water from a bored well which has been made at Syce's Gate (Great Burstead). It is 900 feet deep. The water is derived from the deep chalk, and the official test shews that it is capable of yielding over 100,000 gallons of water a day. The quality is excellent. It is to be hoped that rapid progress will now be made, and that the water will soon be available over the whole area of supply.

PARISHES SUPPLIED BY THE SOUTHEND WATER CO.

North Benfleet	...	Population 180
Vange	...	„ 597
Pitsea	...	„ 358
Bowers Gifford	...	„ 238

The Company's water mains have been carried into all these parishes by arrangement with the Billericay Council. Vange, Pitsea and Bowers have been supplied for two or three years, but the North Benfleet extension has only recently been completed. A 4in. main has been extended from Bowers, and about 20 houses have been directly connected therewith. Stand pipes have been erected for the supply of other houses. The cost of this extension was £1,290.

WICKFORD, pop. 638, at present depends on a public well which yields very little water. An arrangement has been made with the Southend Water Co. for a continuation

of the Benfleet main along the Wickford and Rayleigh road, thence down to the village, with branches and extensions along the London and Nevendon roads. The mains will be laid as soon as the L.G.B. sanction has been obtained.

PARISHES CONNECTED WITH THE SOUTH ESSEX CO.'S
WATER MAINS.

CHILDERDITCH, pop. 225, LITTLE WARLEY, pop. 778, SHENFIELD, pop. 1,962, SOUTH WEALD, pop. 5,933 (including the Essex Lunatic Asylum), WEST HORNDON, pop. 113. Only a few houses in Childerditch are directly connected with the mains, most of the remainder being supplied from a deep well owned by Lord Petre in Childerditch Street. At Little Warley the population fluctuates, as Infantry Barracks are established here. The Barracks and a few cottages are supplied from the mains. There are two public pumps and a few shallow wells. In Shenfield most of the houses are now supplied from the mains. In South Weald the more populous portion of the parish is supplied from mains, but a few houses still depend upon shallow wells and rain-water. The Asylum has its own supply from a deep well. Only a portion of West Horndon is supplied by the Water Co., other houses depend upon shallow wells.

Other parishes through which no mains pass, nor are likely to pass under the new scheme, are :—

Dunton	...	...	Population	137
East Horndon		...	„	425
Ingrave	...	...	„	528
Little Burstead		...	„	248
Mountnessing		...	„	910
Ramsden Bellhouse	...		„	396

In Dunton there is no public well. There are two deep wells and a few shallow wells. Some of the farms

are badly off for water. In East Horndon shallow wells and ponds furnish the whole supply, and Ingrave depends on shallow wells which fail in summer. In Little Burstead there is a public pump supplying the school and a few cottages. One farm possesses a deep well. The remaining houses obtain water from shallow wells and ponds. At Mountnessing the clay has a thin pervious covering, since water is obtainable from shallow wells. These and a spring form the sources of supply. Ramsden Bellhouse is supplied from springs and a few shallow wells. The water yielded by some of these wells contains so much mineral matter that it cannot be used for drinking purposes. It would be difficult to conceive of a district more difficult to supply with water than this, yet these difficulties are being gradually overcome, and in a short time it will be possible to obtain an abundant supply of excellent water in all the more populous and in many of the less populous parishes. Probably when the Billericay scheme is completed, the remaining parishes may receive attention. The help afforded by the Southend Water Co. is much appreciated, as they have far exceeded their legal obligations.

THE MALDON RURAL DISTRICT.

Medical Officer of Health—Dr. THRESH, Chelmsford.

Clerk—A. W. FREEMAN, Esq., Maldon.

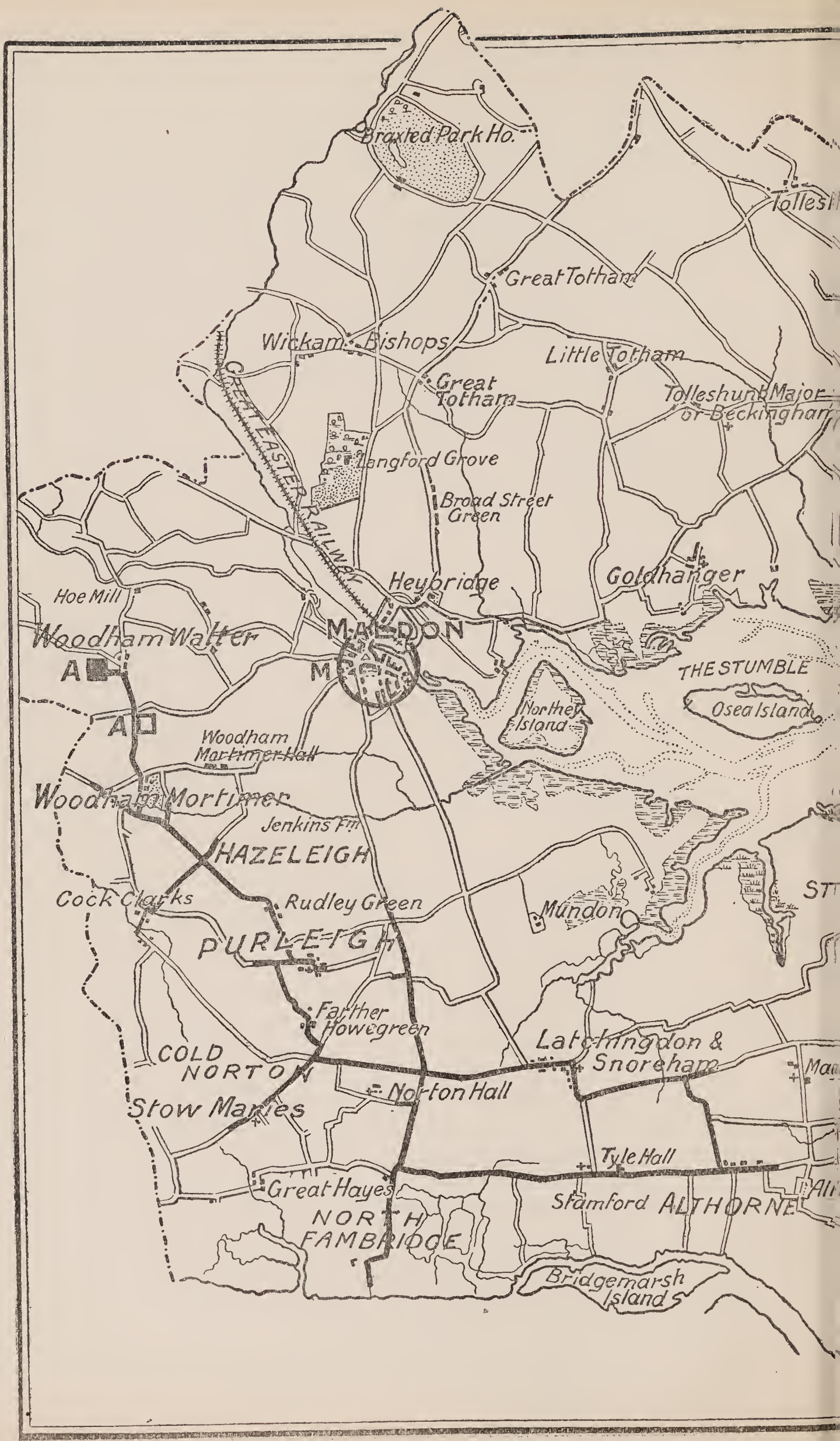
This rural district comprises 23 parishes with a population of 14,633, spread over an area of 82,000 acres. It is therefore one of the most thinly populated portions of the county. It is traversed from east to west by two elevated ridges, one on the north and the other on the south of the Blackwater Estuary, from which fine views can in many places be obtained. The southern ridge also

overlooks the Crouch valley, and water mains practically traverse its whole length.

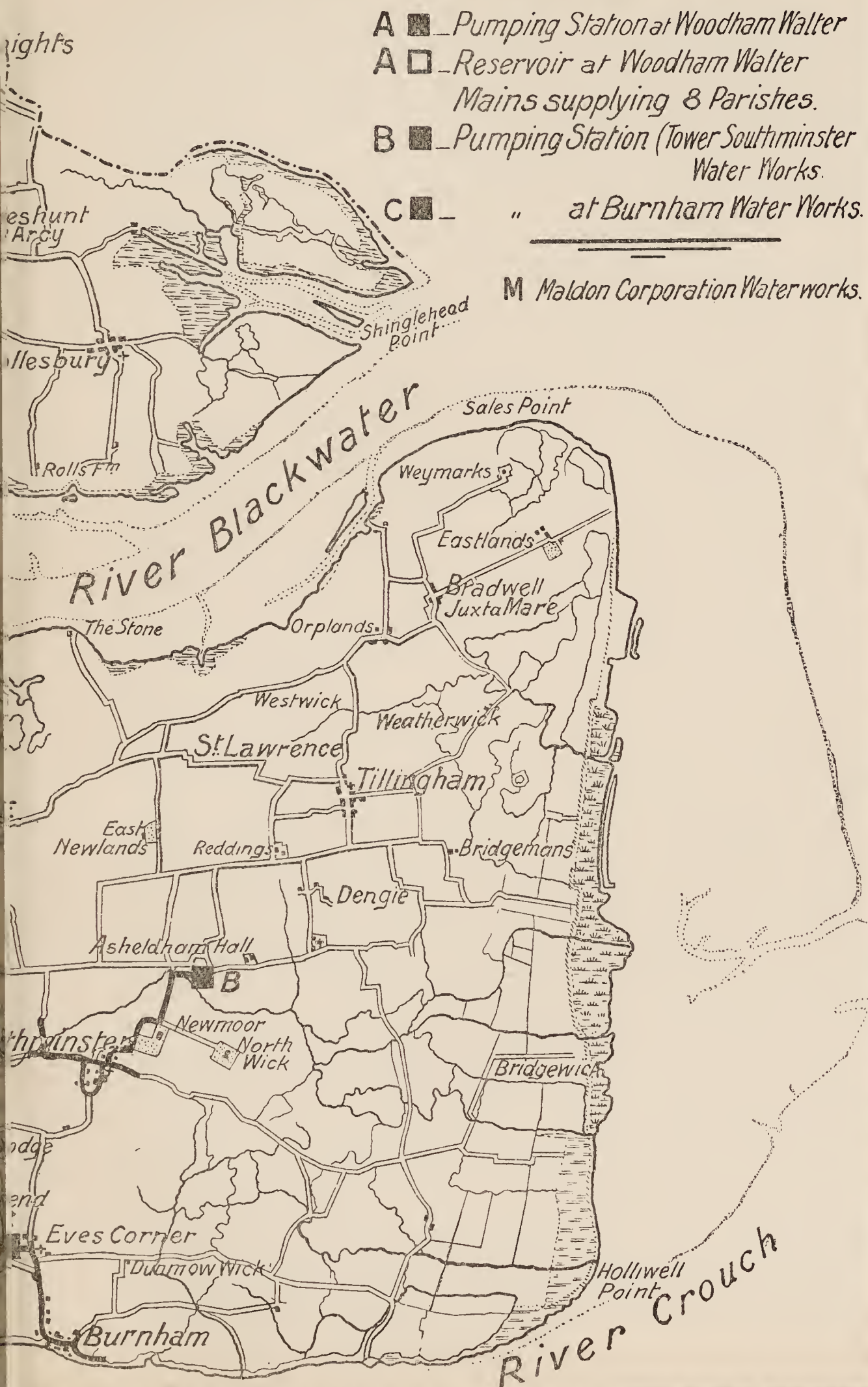
There are three waterworks in the district. The so-called Purleigh waterworks supply the parishes of Woodham Mortimer, Purleigh, Hazeleigh, Stow Maries, Cold Norton, North Fambridge, Latchingdon, and Althorne. The total population of these parishes is only about 2,500, and they are spread over an area of about 20,000 acres. The Southminster Waterworks supply the village and parish of Southminster. The Tiptree Waterworks supply the parish of Tolleshunt Knights.

The Purleigh Waterworks are the most extensive rural works in the County, and the means which the Maldon Rural District Council have adopted for supplying the parishes within the waterworks area with water are well worth the attention of persons interested in the development of our rural districts. The smaller works at Tiptree and Southminster are also well worth attention, exemplifying as they do different ways of providing village supplies.

THE PURLEIGH WATERWORKS. The water used is derived from a series of springs in Woodham Walter parish, which yield from 60,000 to 100,000 gallons of water per day. About 11 acres of ground had to be acquired to protect these springs from pollution, but considerably less would have sufficed, as there are no houses near. The water is collected in a reservoir and pumped up to a distributing reservoir about three-quarters of a mile away at such an elevation as to command all the district supplied. Duplex steam pumps are used, each capable of raising 6,000 gallons per hour from the collecting to the service reservoir, the difference in elevation being 110 feet. From the latter reservoir the mains ramify as shown on the map, and stand pipes are fixed along the route to supply houses and



MAP SHEWING PUBLIC WATER SUPPLIES IN THE MALDON UNION.



farms which are not directly connected with the mains. The total cost of the works was about £13,000. The water is of excellent quality, and not half the present yield of the springs is being used. The introduction of this supply to a previously waterless area has been an immense boon. It has allowed of the development of the dairying industry, and has greatly increased the value of the land along the route of the mains.

The whole area is upon the London Clay, and water was only obtainable from deep wells, or by collecting rain water. An application is now being made to the L.G.B. for an additional loan in order to extend the mains in Hazeleigh and Purleigh parishes to supply more farms and houses. Away from the route of the mains are many houses which have to fetch water from the stand-posts or depend upon the rain-water collected. There are still a few deep wells in use, but the water level is continually falling, and the wells are a constant expense to maintain.

THE SOUTHMINSTER WATERWORKS. These supply Southminster, pop. 1,430. The subsoil is gravel in the village, but marshy towards the sea. The supply of water from the gravel was limited in amount and often impure, hence in 1894 the present works were constructed. A spring in Asheldham, yielding about 50,000 gallons of water per day, is utilized. The water is pumped by steam pumps into a tank on an elevated tower, whence it flows and supplies the whole of the village. The total cost of the work was about £2,000. The water is of excellent quality, and there is much more than meets all present demands.

THE TIPTREE WATERWORKS. These were only completed last year to supply the parish of Tolleshunt Knights which previously had no water, save such as was

collected from roofs or fetched from ponds or a distant brook. The water is raised from a well in the Tiptree gravel by means of pumps worked by a Canadian windmill to a reservoir of concrete in the same field. From here it flows by gravitation through three miles of mains supplying the Britannia Fruit Works, farms and houses *en route*. All the houses are not yet connected. There are groups of houses in this and in the adjoining parish of Tolleshunt D'Arcy without water, and it is hoped to extend the mains to supply these. The cost has been a little over £2,000, and as this is the limit of the borrowing power of the parish, the extensions cannot be made until some of the existing loan has been repaid. The water is of excellent quality, and the yield will probably average 20,000 gallons per day.

ASHELDHAM. Pop. 172. Subsoil gravel and clay. The cottages near the Southminster Waterworks are now supplied from a standpipe. There are many scattered houses dependent upon rain water for a supply.

BRADWELL. Pop. 783. Subsoil brickearth in the village, clay on the marshes. Water is fairly abundant, and derived from two public and numerous shallow wells.

CRICKSEA. Pop. 105. Gravel and clay. There are one or two deep wells supplying private houses. The public well (shallow) yields a very limited supply. A better water supply is greatly needed, and could be obtained by extending the water mains from Althorne.

DENGIE, ST. LAWRENCE AND MAYLAND. Pop. 535. Neighbouring parishes with a very scattered population. Subsoil chiefly London clay; there is a little gravel at Dengie, but the shallow wells there yield a very limited amount of water. A few of the farms have bored wells, but the water level is falling and the yield diminishing. There is a great dearth of water in the two latter parishes.

Water for the Mayland School has to be carted over half a mile from a standpipe at Althorne. The Purleigh mains may at some time be extended into Mayland, but the expense at present is considered prohibitive. Rain water has to be depended upon, collected from roofs or in ponds. Houses within a reasonable distance of the standpipes in Althorne can by arrangement obtain water therefrom.

TILLINGHAM. Pop. 797. The village has a sandy subsoil from which water is obtainable, but not in sufficient quantity at all seasons. There are six public wells, and to supplement the supply a pump is fixed near to and drawing water from a brook. Suggestions have been made for a public supply or to connect with the Southminster works, but with a diminishing population the parish council strongly object to the necessary expenditure.

STEEPLE. Pop. 359. Subsoil London clay. The whole population is practically dependent upon two public deep wells, no other source being available. Water from these wells, which are situated at opposite ends of the village, is carted considerable distances to supply the farms and isolated cottages.

MUNDON. Pop. 227. Subsoil clay. The only water obtainable, save from roofs and ponds, is from deep wells. Some time ago a disused well in the village was opened out, the bore tube cleaned, etc., but so little water could be obtained that it has been again abandoned. A sunk well (300 ft.) at the Hall yields most of the drinking water, but it has to be carried a considerable distance. The parish greatly needs a water supply, and the Rural District Council are now considering various proposals, but the amount which so small and thinly populated a parish can afford to spend, renders it very difficult to devise any satisfactory scheme.

HEYBRIDGE. Pop. 1,687. Chiefly on clay, a little gravel to the north. Water is chiefly obtained from the sands overlying the chalk, which here are reached at the moderate depth of 100 ft. There are several such wells, the most important being that at the Ironworks. Most of the houses in the village belong to Messrs. Bentall, and they are supplied with water from the works, mains being laid to standpipes near the houses. Other inhabitants use this water, and it has been suggested that the Rural District Council should take over the supply and extend the mains. The matter has been under consideration for some time. The outlying parts to the north are supplied from shallow wells.

GOLDHANGER. Pop. 385. Subsoil loam and clay. There are a few shallow wells supplying water of doubtful quality, and a few deep wells. The public well (with pump) in the centre of the village has recently been deepened and greatly improved. It yields most of the water used for domestic purposes. Rain water is collected and in several instances is the only water available.

TOLLESHUNT D'ARCY. Pop. 753. Subsoil, gravel under village, clay elsewhere. Shallow wells are numerous. There are several springs utilized by cottages and farms. Some of the outlying parts suffer considerably from want of water.

TOLLESBURY. Pop. 1,720. Subsoil chiefly gravel. There are three public wells with pumps and very many private wells, but the supply is very deficient, and the quality far from satisfactory. A public supply is an urgent necessity, as there is not sufficient water to flush the sewers. The new light railway from Kelvedon terminates here, and Tollesbury is likely to become an important yachting centre. Without water its development must be greatly retarded. Water could be obtained

from a deep well. There is one such well on the marshes sunk to supply the cattle.

TOLLESHUNT MAJOR or BECKINGHAM. Pop. 431. Subsoil chiefly clay. There are small patches of gravel here yielding a little water, but the supply, from shallow wells, is very limited. The Rural District Council are arranging with the owners of a small spring to pipe the water to the roadside to supply a few additional cottages.

GREAT AND LITTLE BRAXTED. Pop. 388. Subsoil gravel. Supply of water from a public pump at Great Braxted, and from springs and shallow wells. There is no complaint as to quality or quantity.

GREAT AND LITTLE TOTHAM. Pop. 956. These extensive parishes depend entirely upon shallow wells and springs, but the supply generally is not abundant. There is a public pump at Great Totham, and at Little Totham a spring water has been piped to the roadside. Some houses derive their supply from brooks liable to pollution. The scattered population renders it impossible to devise any scheme of public supply which could be carried out at a reasonable cost.

WICKHAM BISHOPS. Pop. 466. Stands on an elevated tract of gravel which contains water, yielding it much more freely in some places than in others. One of the springs has been enclosed and rendered accessible to the public. A few houses are without a proper supply.

WOODHAM WALTER. Pop. 406. Subsoil gravel. Springs are very abundant here, and one is utilized for supplying the Purleigh district. Others are piped into the village street. There are many private wells, and a few houses derive water from a brook.

ULTING AND LANGFORD. Pop. 362. Subsoil gravel and clay. Water fairly abundant. Wells and springs are utilized for private supplies. There are two public pumps

in Langford, and an open well in Ulting. Many houses are at some distance from the sources of supply.

THE CHELMSFORD RURAL DISTRICT.

Medical Officer of Health—DR. THRESH, Chelmsford.

Acting Clerk—A. DUFFIELD, Esq., Chelmsford.

This district is situated in the centre of the county and comprises 29 parishes with a population of about 24,000. The district is very undulating, and several of the parishes stand on considerable elevations capped with gravel. The most elevated parishes are Danbury, Stock, Ingatestone and Fryerning, part of Great Baddow, and Galleywood Common.

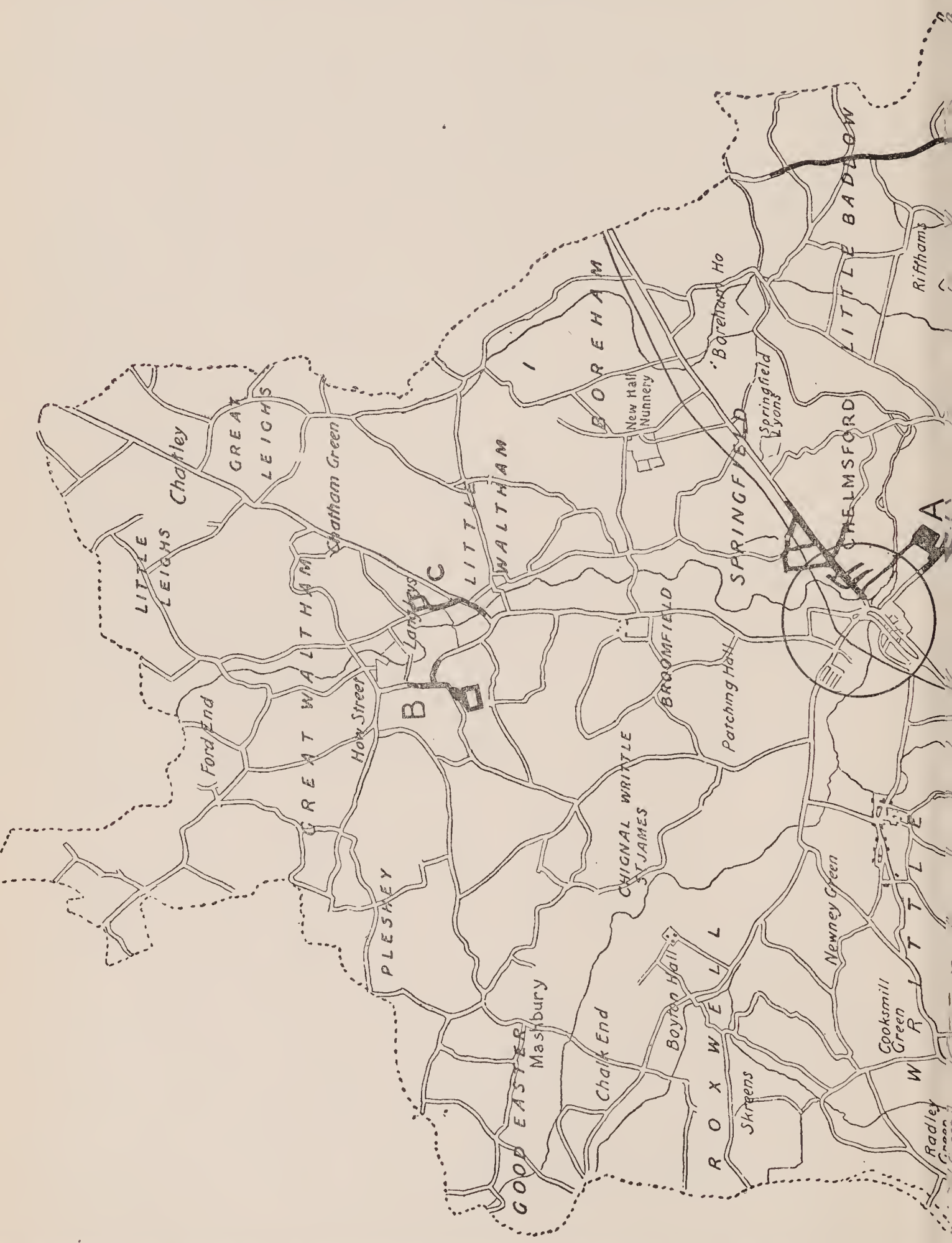
There are two public water supplies with extensive systems of mains and two villages are supplied with water from smaller works.

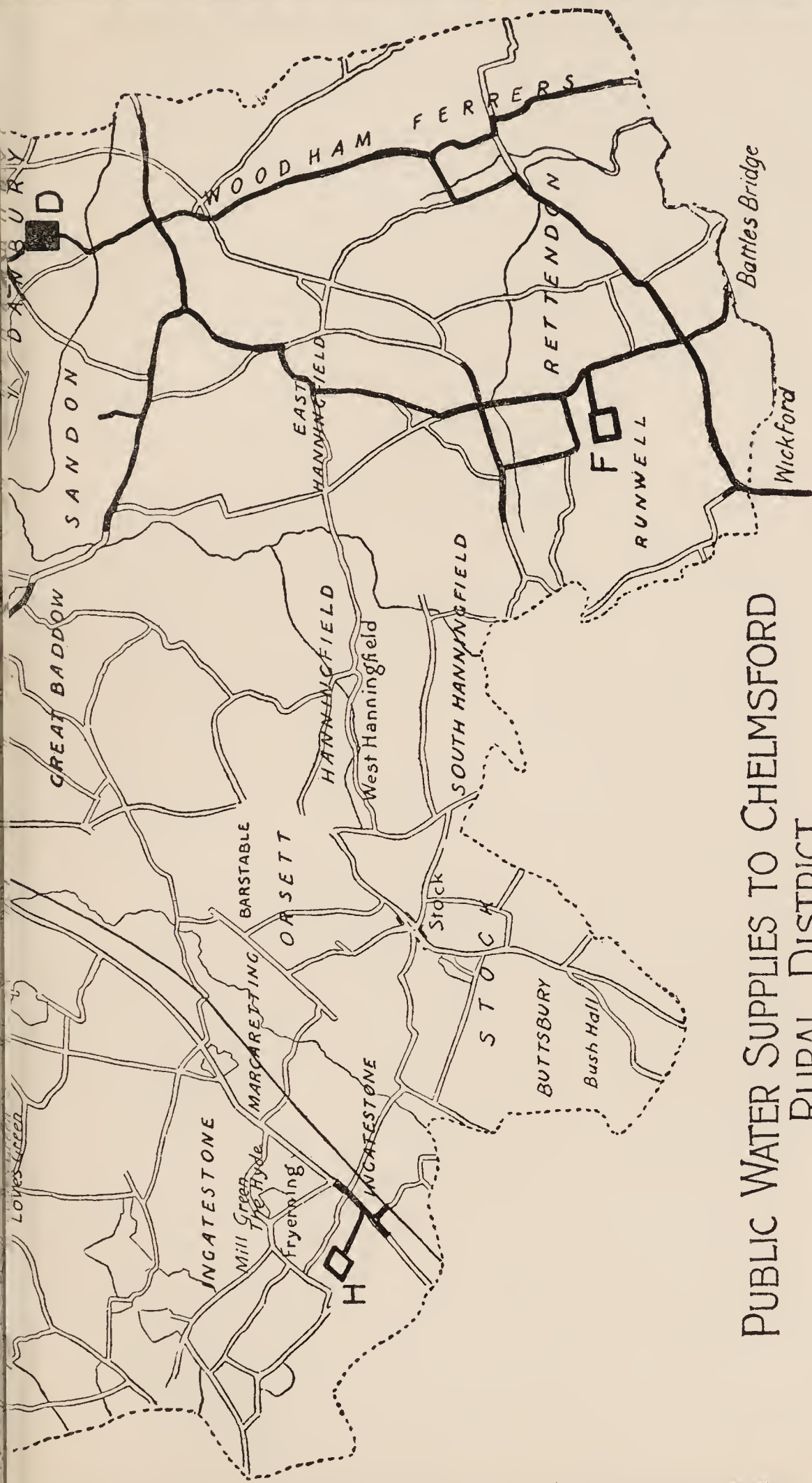
SPRINGFIELD AND GREAT BADDOW, suburbs of the town of Chelmsford, are supplied from works situated in Great Baddow, the water being derived from springs supplemented when necessary by water from a well over 300 feet deep. The available water is far more than is necessary for the present requirements of the two parishes.

A new main is being laid to Springfield in order to supply water to the highest houses under an increased pressure. Practically all the houses along the route of the mains are connected therewith.

The subsoil is gravel on the higher ground and clay elsewhere. At the outskirts of these parishes there are many houses supplied by wells. The population at the 1901 census was 5,582 and is increasing.

THE DANBURY WATERWORKS supply the parishes enumerated below. The water is derived from springs arising on the common and is excellent in quality and





PUBLIC WATER SUPPLIES TO CHELMSFORD RURAL DISTRICT.

- A. Pumping station Tower & springs for Gt. Baddow & Springfield Waterworks.
- B. Gt. Waltham Waterworks C Lt Waltham Waterworks
- D. Pumping Station & springs at Danbury Waterworks, supplying water in 7 parishes.
- E.&F. Reservoirs H Ingatestone Waterworks

abundant. The water is collected in a covered reservoir and flows by gravitation to Bicnacre, East Hanningfield, Woodham Ferris, Rettendon, Runwell, and part of Sandon. A portion is pumped by means of gas engines to a small tank at the top of Danbury Hill whence it flows to Danbury and Little Baddow (*vide* Map).

DANBURY population 849, is entirely on gravel. Springs and wells supply the houses and farms not near the water mains. About 20 cottages near Gay Bowers are dependent upon rain water.

LITTLE BADDOW, population 510, is also on gravel. The water main runs down the hill from Danbury past the majority of the houses which are supplied therefrom. Other houses are supplied from springs and shallow wells.

EAST HANNINGFIELD, population 418 ; WOODHAM FERRIS, population 878 ; RETTENDON, population 692 ; and RUNWELL, population 239, are all on the London Clay and prior to the construction of the waterworks experienced great difficulty in obtaining water. There were a few deep wells, some of which are still used, and a few shallow wells sunk in small pockets of gravel. The water mains now ramify through the parishes and to supply the more distant parts stand pipes are erected at the roadside from which water can be carted. There are a few farms and cottages which have to fetch the water from a distance or depend upon rain water collected in tanks or ponds. The cost of carrying mains along all the by-roads is economically impossible.

SANDON, population 398, subsoil clay and sand. The village is on a loam from which water is obtainable by sinking wells. One public well supplies most of the houses. Butts Green and Howe Green are supplied from the Danbury mains.

This is one of the rural water supplies which is well worth examining by any one interested in the question of providing public supplies for thinly populated rural districts. The last mentioned parishes on the London Clay from being the worst supplied with water have now as good and as abundant a supply as any parishes in the county.

GREAT WALTHAM, population 2,021. This parish is on gravel and boulder clay. The village is supplied with water from a number of standpipes, the water being pumped by a ram from a spring near The hamlet of Ford End is supplied by a spring piped to the roadside and by a public pump. At North End a spring has been piped to supply such houses as are distant from the public well. At Rolphy Green a few cottages are supplied from a pond, attempts to obtain water by well sinking having failed. At Chatley Hamlet the well supply is not sufficient. Attempts to obtain water for cottages on the Braintree Road have resulted in failure.

LITTLE WALTHAM, population 646. The subsoil is gravel and several large springs arise from it, one of which is utilised to supply the village, the water being conveyed by gravitation to standpipes in the street. A few isolated cottages are dependent upon pond water.

INGATESTONE WITH FRYERNING, population 1,748. Subsoil sand and clay. Elevation, 200 to 300 feet above ordnance datum. The village of Ingatestone has a public supply derived from the chalk, the well being some 700 feet deep. The works are not quite completed. Until last year the supply was derived from springs. The water is laid on to nearly all the houses. There are two or three public wells with pumps to supply groups of cottages at a distance from the village. Save at Green Street water is obtainable in all parts of both parishes.

BOREHAM, population 820, subsoil gravel and sand. Springs abound in the parish, two of which are utilized as public sources of supply. There is also a public well. Whilst water is obtainable over most of the area there are localities towards the boundaries of the parish where the sand is covered with a considerable thickness of boulder clay, and wells here (20 to 40 feet deep) yield very little water and that of an unsatisfactory quality.

BROOMFIELD, population 911. This parish adjoins the town of Chelmsford and the subsoil is chiefly gravel and brickearth. Water is derived from about 50 shallow wells and from two springs. Most of the wells are only a few feet deep, but some are 30 to 40 feet deep. At the centre of the village, near the church, water is not abundant and the question of providing a public supply has been considered. The owner of the only available spring refused to sell and for the present the scheme is in abeyance.

CHIGNALS, population 367, subsoil chiefly clay, a little river gravel. The scattered houses are supplied from private wells, springs, and one public well sunk in 1897. Water is not very abundant and that derived from beneath the boulder clay is very hard.

GREAT AND LITTLE LEIGHS, population 757. Chiefly on gravel, some boulder clay. There is a public well with pump in each parish, but most of the houses are supplied from private wells. Where the boulder clay is thickest the wells are some 60 feet deep. Here and there are found cottages dependent upon rain or pond water, the cost of obtaining a supply from a well being greater than the Sanitary Authority can compel the owners to spend.

MASHBURY AND GOOD EASTER, population 662. Chiefly on boulder clay. Good Easter village is supplied

by two public wells, 70 or more feet in depth. There are few private wells. In Mashbury the cottages are very scattered. There is one public pump. Over most of this area water is not easily obtainable. The population is too scattered for a public supply hence there are many cottages using rain water, pond, or brook water.

PLESHEY, population 231, subsoil gravel chiefly. The village is supplied by three public wells with pumps and by a few private wells. There are a few outlying cottages without a proper supply, nor can such supply be obtained at a reasonable cost.

MARGARETTING, population 551, subsoil sand and clay. There are two public pumps yielding a limited amount of water, which is very hard but otherwise of good quality. A deep well has recently been bored to supply a private house and the water obtained is excellent in quality. Another deep well yields water containing much sulphate of magnesia (Epsom salts). A few outlying cottages have not a proper supply.

ROXWELL, population 696, subsoil clay with a little gravel in river valley. A spring rises near the Church and is piped into the village street. There are other springs and a few shallow wells which are utilised. In 1900 an outbreak of Typhoid Fever occurred, confined entirely to persons using the brook water. A well has been sunk near here (Boyton Cross), but a few people still use the brook water rather than fetch water from the pump.

SOUTH AND WEST HANNINGFIELD, population 583. These parishes are on the London Clay and the scattered population is not well supplied with water. A very deep boring was recently made (some 500 feet) but no water was obtained. Many of the houses are at too high a level

and too far from the Danbury mains to be economically supplied therefrom. Many houses in South Hanningfield are supplied by a spring at the Windmill Inn. Another spring supplies most of the cottages in West Hanningfield. In both places the water has usually to be carried some distance hence many persons use pond water or even water from the roadside ditch (brook?). Rain water "separators" have been fixed at a few new cottages.

STOCK AND BUTTSBURY, population 1,117. The village of Stock is on a sandy subsoil, but most of Buttsbury parish is on clay. The sand in the village yields a limited amount of water but it is not of a satisfactory quality. Most of the private houses obtain a fair supply of water from wells 20 to 50 feet in depth. There are many houses using water derived from unsatisfactory sources. The question of providing a public supply has been discussed several times by the District Council and a scheme is now under consideration. If it could be made to include South and West Hanningfield it would be an advantage.

WIDFORD, population 323. This parish adjoins Chelmsford and one side of the village street is in the Borough. The Borough water mains extend to the village and supply most of the houses. The outlying houses are supplied from private wells and springs.

WRITTLE AND HIGHWOOD, population 2,718. Subsoil chiefly gravel and loam. Highwood is a distinct ecclesiastical parish but is included in the civil parish of Writtle. In Highwood the population is very scattered and water is obtained chiefly from shallows wells. There are two public wells. Rain water has to be depended upon in several cases, no other water being obtainable at a reasonable cost. In Writtle a waterworks is nearing completion which will

supply all the village. The water is being derived from a deep well in the chalk. It will be pumped into a tank standing on a tower near the well and thence will flow by gravitation to supply all the houses. There are numerous wells in the village but the subsoil is so polluted that nearly all the wells yield contaminated water. These wells will be closed as soon as the waterworks are completed. The water from the deep well is of excellent quality, but the pumps bring up a good deal of fine sand. No doubt this will cease after the well has been in use for a time.

The appended map shows the distribution of the various water mains in the Chelmsford Rural District. Speaking generally the area is well supplied with water, but there are localities where good water is very difficult to obtain. The worst portions are (*a*) road leading from Rettendon Common to East Hanningfield and a second road from the Common to Bicnacre, (*b*) back road leading from Great Leighs to Little Waltham, (*c*) houses near Chatham Green and on Braintree Road, (*d*) Littleley Green, (*e*) various by-roads at Woodham Ferris, and (*f*) the parishes of Stock, Buttsbury, South and West Hanningfield.

THE STANSTED RURAL DISTRICT.

Medical Officer of Health—DR. R. A. DUNN, Grove Cottage, Hertford.

Clerk—A. G. GWYNN, Esq., Bishop Stortford.

The district includes 10 parishes with a population of nearly 7,000.

Stansted is the only parish with a proper water supply distributed by mains.

The chalk is exposed in the north-east of the district, elsewhere it is covered with clay, or clay and gravel.

The following description of the water supplies has been furnished me by Mr. E. J. Watts, the Surveyor, who has an intimate knowledge of the district.

BERDEN, population 286, subsoil clay with some chalk and gravel. This parish is fairly well supplied with water from wells of various depths, from 90 feet to 120 feet, dug into the chalk. Nearly all these wells have been deepened a few feet during recent years.

BIRCHANGER, population 753, subsoil clay and loam. Water supply from a well about 90 feet deep. The isolated cottages get their supplies from wells at the farm-houses. In the north-west end of the village, about 25 new cottages have been erected during the last 10 years, these are provided with water from wells varying from 20 feet to 30 feet deep.

ELSENHAM, population 453, subsoil clay and gravel. The village proper is supplied from a well about 90 feet deep. This well was sunk by Sir Walter Gilbey in memory of the late Lady Gilbey. The isolated cottages are supplied by springs and wells.

FARNHAM, population 431, subsoil chalk. With the exception of some cottages at Chatter End, and a portion of Farnham Green the parish is fairly well supplied with water from wells and a spring, which has a pump over it. An attempt has been made to get a better supply for Farnham Green, but, unfortunately, after sinking down about 120 feet there was no sign of water, so that the attempt was abandoned.

GREAT HALLINGBURY, population 514, subsoil sand and Boulder Clay. With the exception of a few cottages the houses belong to Col. Archer Houblon, and the parish is fairly well supplied with water from wells varying from 30 feet to 80 feet deep.

LITTLE HALLINGBURY, population 575, subsoil gravel and Boulder Clay. The village is supplied with water from two wells about 10 feet deep in the gravel. The isolated cottages are supplied from wells about 35 feet deep, also in the gravel.

HENHAM, population 700, subsoil Boulder Clay. The wells vary considerably in depth. Chalk is found at a depth of about 25 feet. The water from about eight of the wells has been analysed, and proved to be rather unsatisfactory. A well was sunk about two years ago to a depth of about 60 feet without finding any water. After a heavy rain the water percolated into this well from the surface, analysis proved that the well was liable to pollution, and the water is now only used for washing, &c. The supply is very limited in dry weather so that a public supply is greatly to be desired.

MANUDEN, population 660, subsoil clay, chalk, and gravel. The village is very fairly supplied from wells varying from 15 feet to 25 feet in depth. There are one or two private bored and tubed wells into the chalk about 90 feet deep. The subsoil is chiefly gravel over chalk. There are some cottages at Up End very badly off for water, but unfortunately the expense of providing a supply is very great and the rateable value will not at present warrant the expense. Water is obtainable by going about half a mile to the farm.

STANSTED MOUNTFITCHET, population 2,208, subsoil clay, gravel, and chalk. The village is supplied by a private company. The well is about 100 feet deep, with a bore hole 100 feet deeper into the chalk, and there appears to be an unlimited supply. The houses at Burton End are fairly well supplied from wells varying from 20 feet to 30 feet deep.

UGLEY, population 305, subsoil clay and gravel. This village is supplied from wells varying from 20 to 30 feet deep, with the exception of about 10 cottages at Patmore End. This is another case where the expense of providing a supply would be more than the value of the cottages. The Council has recently urged upon the owners of property the necessity of improving the existing supply, but up to the present no definite steps have been taken.

Of the parishes in this district Henham is the worst supplied with water and the Sanitary Authority should endeavour to improve the supply. The other parishes are fairly well supplied. As the chalk lies at or comparatively near the surface throughout the whole area there should be little difficulty in obtaining water. There is some uncertainty, however, as shown by the Farnham boring since where the chalk is dense and free from fissures it yields no water and apparently this is the case in certain portions of this district.

THE ONGAR RURAL DISTRICT.

Medical Officer of Health—DR. QUENNEL, Brentwood.

Clerk—A. RICHARDSON, Esq., Ongar.

This thinly populated district comprises an area of over 47,000 acres on which there is a population of 10,044 in 26 parishes, many of which are very small. The subsoil is Boulder Clay or London Clay, save near Ongar where there is a considerable area of gravel and at Kelve-ton Hatch where there is a deposit of Bagshot sand. There are very few deep wells in the district, though water could probably be obtained anywhere at a depth of 300 to 400 feet. Possibly the yield of any one well would be small. The Herts and Essex Water Co.'s mains extend

into two parishes, Bobbingworth and Lambourne, and a small private water company supplies Chipping Ongar (the town of Ongar), High Ongar, and Shelley.

Parishes supplied by water companies :—

Bobbingworth	...	Population	270
Lambourne	...	„	938
Chipping Ongar	...	„	967
High Ongar	...	„	1,117
Shelley	... ..	„	158

Out of the above population about 2,250 are supplied by the Water Companies, about 200 are supplied from public pumps and the remainder, in about equal proportion, depend upon private wells and ponds.

In the following parishes there are no public wells and the inhabitants depend upon private shallow wells, ponds, and ditches. The Roothings (three parishes), population 511; Doddinghurst, population 371; Fyfield, population 548; Greenstead, population 110; Kelvedon Hatch, population 361; Little Laver, population 92; Norton Mandeville, population 131; Shellow Bowers, population 88; Stapleford Abbots, population 364; Stapleford Tawney, population 224; Stondon Massey, population 233; Willingales, Doe and Spain, population 455; and High Laver, population 386.

In the following parishes there are public wells supplying about half the population, the remainder obtaining water from shallow wells and ponds :—Blackmore, population 619; Moreton, population 378; Navestock, population 692; Theydon Mount, population 123; and Stanford Rivers, population 908.

It is obvious from the above description that the water supply to a considerable proportion of this district is of a very unsatisfactory character. No doubt it is difficult to supply such a scattered population, but some

arrangement could possibly be made with the Essex and Herts Co. to extend their mains especially into Stanford Rivers and Toothill. Probably also it would be found possible to group the parishes and provide a supply for each group at a cost which under the circumstances would be reasonable.

THE BRAINTREE RURAL DISTRICT.

Medical Officer of Health—DR. BLACK, Braintree.

Clerk—F. SMOOTHY, Esq.

This district has an area of 62,291 acres and a population of over 18,000 in 23 parishes. A considerable area is covered with gravel. Hence water is fairly abundant. Only in a few parishes is there any difficulty in obtaining it and very few houses depend for their supply upon ponds or brooks. No less than six of the parishes have a population of over 1,000. The most populous are

FINCHINGFIELD, population 1,333. There is no public supply here, the whole population depending upon private wells, which are numerous. A new well was sunk last year to supply certain farms and cottages which previously depended upon ponds and ditches.

WETHERSFIELD, population 1,115, subsoil clay and gravel. There is one public pump here. Private wells are numerous.

BOCKING, population 3,347, subsoil gravel and clay. This is really a part of the town of Braintree, but the Braintree mains only supply a small portion of the population. There are many shallow wells and a few deep ones. The supply is certainly not sufficient for so large a population.

GREAT COGGESHALL, population 2,578, subsoil chiefly gravel. There is an ancient well (St. Peter's well) almost in the centre of the parish from which pipes are laid

through the main streets. More distant houses cart water from this well. There are numerous private wells, and several springs. The few deep wells here yield water freely.

KELVEDON, population 1,569, subsoil gravel and loam. This populous village is dependent upon one public pump and a number of private wells. One or two of the latter pierce the London Clay and yield water readily.

HATFIELD PEVEREL, population 1,208, subsoil clay and gravel. Supplied almost entirely by private wells.

TERLING, population 799, subsoil clay, patches of gravel. There is a public supply here, water being raised from a spring by means of a ram and conveyed to the houses by mains. Stand pipes are fixed in the streets. A small portion of the parish is supplied by a spring rising near the school.

WHITE NOTLEY, population 335, subsoil clay and gravel. A spring is piped here to standpipes in convenient positions.

The remainder of the parishes are chiefly on gravel and are fairly well supplied with water from public and private wells. Very few are dependent upon rain water or ponds.

Parish.	Population.		No. of public pumps.	
Cressing	...	565	...	3
Fairstead	...	251	...	1
Black Notley	...	655	...	1
Faulkbourne	..	148	...	1
Stisted...	...	581	...	1
Feering	..	704	...	2
Bradwell	...	216	...	3
Pattiswick	...	296	...	3
Shalford	...	515	...	1
Saling	...	202	...	1

Parish.	Population.	No. of public pumps.
Marks Hall	38	—
Little Coggeshall	304	—
Rayne	387	1
Panfield	226	—

It will be observed that nearly the whole of this important district is dependent upon shallow wells. That parishes like Bocking and Great Coggeshall which are really towns should be dependent upon such a source is somewhat surprising. The question of providing public supplies has been frequently discussed by the Rural District Council, and it is possible that a comprehensive scheme could be prepared for supplying all the more important parishes from one common source.

THE DUNMOW RURAL DISTRICT.

Medical Officer of Health—Dr. E. E. GOODBODY, Great Bardfield.

Clerk—S. GIFFORD, Esq., Dunmow.

This district has an area of 73,503 acres and a population of 15,820, residing in 25 parishes. Many of these parishes are very small or very thinly populated, but the district contains a few large and populous parishes none of which have a public water supply. Two rivers rise in this district, the Roding at Little Canfield, the Can near Great Canfield, and the Chelmer rises just over the border of the district and flows through Thaxted to Dunmow thence on to Chelmsford. A little gravel is exposed in the river valleys but boulder clay covers most of the elevated ground. The chalk comes near the surface to the north of the district.

THE ROTHINGS comprise five parishes all on the boulder clay. They are thinly populated and depend entirely upon shallow wells for their water supply :—

Aythorpe Roding, pop. 197, supplied by 13 private wells					
Leaden	„	„	177,	„	9 „
High	„	„	399,	„	2 public & a few private wells.
Margaret	„	„	210,	„	10 „
White	„	„	375,	„	15 „

BRANSTON, population 170, subsoil loam. There are 10 private wells and one public fountain near the School supplied by a spring at a higher level.

BROXTED, population 531, subsoil boulder clay. This parish is supplied by five public wells.

BARDFIELD SALING, population 251, subsoil loam and clay. Water supplied chiefly from two public wells, but there are a number of private wells.

CHICKNEY, population 20, clay subsoil. Supplied from private wells.

FELSTEAD, population 1,945, subsoil clay and gravel. This populous and important parish, with its large public school, has no public supply, though one is much needed. There is a public pump in the centre of the village and about 14 private wells. The wells are 30 to 40 feet deep. The school is supplied from a deep well and various tube and shallow wells. A spring yielding about 17,000 gallons of water per day occurs some half mile from the village and the Local Government Board sanctioned a scheme for utilising this for supplying the village. The water was to be raised by means of a windmill. Although sanctioned the Rural Council have taken no steps to carry out the scheme. At present the spring works a ram and supplies three houses only.

CANFIELD, GREAT and LITTLE, population 526, subsoil boulder clay. Supplied by two public wells and several private wells, one of which is believed to be deep and derive water from the chalk.

BARDFIELD, GREAT, population 806, subsoil gravel. The main portion of the village is supplied from a public fountain, the water being derived from a spring on higher ground. In addition there are private wells, and the supply generally is said to be good and abundant.

BARDFIELD, LITTLE, population 238, subsoil gravel. There is no public well, the houses being supplied from private wells.

DUNMOW, GREAT, population 2,704, subsoil chiefly gravel. There are three public wells with pumps, and two public fountains supplied from springs derived from cultivated land. There are a large number of private wells of the shallow type. The two breweries have deep wells into the chalk. Many of the shallow wells and springs yield water of an unsatisfactory character. There are very few towns (if any) of the size and importance of Dunmow without a public water supply and the Rural District Council recognising this fact have invited two water engineers to submit competitive schemes.

DUNMOW, LITTLE, population 265, subsoil boulder clay. There is one public well in the centre of the village which yields a good supply of water. There are also a number of private wells.

HIGH EASTER, population 652, subsoil boulder clay. There is one public well about 90 feet deep. The water level fluctuates greatly, the well being chiefly fed by a land spring. This causes great difficulty with the pump. There are a few private wells. This parish is not satisfactorily supplied with water.

HATFIELD BROAD OAK, population 1,599, subsoil gravel and boulder clay. There is a small public supply here. Water is collected from a spring in a kind of open reservoir or pond and supplies three stand pipes in the village. There are three public wells, including one at Hatfield Heath.

LINDSELL, population 187, subsoil clay and gravel. Supplied from 12 private wells.

EASTON, LITTLE, population 325, subsoil sand and gravel. A deep well has just been sunk to supply the Lodge. There is a private fountain near the post office supplying a few houses, the remainder are supplied with water from shallow wells.

EASTON, GREAT, population 644, subsoil chiefly clay.

STEBBING, population 911, subsoil clay and gravel. There is one public well and numerous private wells deriving water from the gravel.

THAXTED, population, 1,659, subsoil gravel. This is another very large village without a public supply, although a large spring near is available. There are eight public shallow wells and a number of private wells.

TILTY, population 80, subsoil clay and gravel. Supplied from private wells.

TAKELEY, population 815, subsoil sand, clay, and loam. Supplied entirely by shallow wells, three of which are public or presumably belong to the Sanitary Authority.

From the above description it is evident that in several parishes the water supply admits of great improvement and the subject is one which should receive the attention of the Rural District Council. There is a tendency to give too much prominence to the views of the individual parishes, whereas the responsibility for the water supply rests entirely upon the District Council.

THE SAFFRON WALDEN RURAL DISTRICT.

Medical Officer of Health—Dr. ARMISTEAD, Stapleford,
Cambs.

Clerk—T. COLLINS, Esq., Saffron Walden.

This district comprises 25 parishes with an area of 59,957 acres and a population of 10,764. The northern portion is on chalk, but to the south this formation is overlaid by boulder clay. Dr. Armistead says that the chalk yields a sufficient supply and when the wells are properly constructed and protected from pollution the supply is wholesome. The water level or line of saturation in the chalk falls northward from about 218 feet at Rickling Green, through Newport, Wendens, Littlebury to Great Chesterford where it is 124 feet above Ordnance Datum. During the past year seven public supplies have been improved and a new filter has been put down at Littlebury Green. The supplies, &c., of each parish are summarised below.

ARKESDEN, population 260, subsoil chiefly boulder clay. One public pump supplied by a well 84 feet deep.

ASHDON, population 628, subsoil chiefly boulder clay. Two public pumps, one supplied by a well in the chalk 53 feet deep, and the other by a spring.

BARTLOW END, population 172, subsoil clay and chalk. One reservoir and standpipe.

GREAT CHESTERFORD, population 785, subsoil chalk. No public works, numerous private wells mostly supplied from the chalk.

LITTLE CHESTERFORD, population 209, subsoil chalk. No public works, several private wells mostly in chalk.

CHRISHALL, population 460, subsoil chalk. Six public pumps supplied from springs or ponds.

CLAVERING, population 835, subsoil boulder clay. Four public pumps, one supplied from a well in the chalk, 105 feet deep, and the others from springs in gravel.

DEBDEN, population 644, subsoil boulder clay. One public pump and well.

ELMDON, population 544, subsoil chalk. Two reservoirs and standpipes.

HEMPSTEAD, population 499, subsoil boulder clay. One reservoir and public fountain and one pump and well supplied by a spring.

HADSTOCK, population 356, subsoil chalk and clay. No public works.

LANGLEY, population 317, subsoil boulder clay. No public works.

LITTLEBURY, population 628, subsoil chiefly chalk. Three public pumps, two supplied from one deep bored tube well in the chalk and one supplied by filtered pond water.

NEWPORT, population 914, subsoil chalk and boulder clay. Two public pumps, one supplied from a deep bored tube well, 132 feet deep, 60 feet being in chalk.

QUENDON, population 126, subsoil chalk, boulder clay, and gravel. One deep well with wheel pump, provided by Colonel Byng.

RADWINTER, population 689, subsoil gravel and clay. One public pump supplied by a spring.

RICKLING, population 394, subsoil boulder clay. One public pump and well.

GREAT SAMPFORD, population 404, subsoil boulder clay. No public works.

LITTLE SAMPFORD, population 388, subsoil boulder clay. One public pump and well.

STRETHALL, population 62, subsoil chiefly chalk.

One public pump and well supplied by a gravel spring in the boulder clay.

WENDEN AMBO, population 377, subsoil chiefly chalk. One pump over deep well, dug 50 feet and bored 299 feet into the chalk, total 349 feet, the property of Lord Braybrooke, several private wells on the chalk.

WENDEN LOFTS, population 65, subsoil chiefly chalk. No public works, a very small parish supplied by pond and one well in the chalk.

WICKEN, population 138, subsoil chalk and gravel. Two public pumps and wells.

WIDDINGTON, population 342, subsoil chalk and boulder clay. One brick reservoir, supplied by a spring with stand pipe in the village.

WIMBISH, population 578, subsoil boulder clay. No public works.

This report shows that better supplies are much wanted in Langley, Newport, and Hadstock. Water could be obtained at Langley by sinking deep wells through the boulder clay into the chalk, but on the upper green the depth would have to be 200 feet. At Newport, the most populous parish, a public supply could be obtained from an existing bored well opposite Station Road. At Hadstock the chalk would have to be reached by piercing the boulder clay.

THE HALSTEAD RURAL DISTRICT

Medical Officers of Health—DR. ASHWORTH, Halstead, and DR. BROMLEY, Castle Hedingham.

Clerk—R. L. HUGHES, Esq., Halstead.

This district comprises an area of 39,359 acres and a population of 10,176 residing in 16 parishes. It lies

within the drainage area of the River Colne, and in the valleys of its tributaries there is a certain amount of gravel exposed, but the higher ground is chiefly boulder clay. There are no waterworks in the rural area. Most of the population depends upon shallow wells and springs, but in nearly every parish there are houses taking water from brooks, ponds, &c.

CASTLE HEDINGHAM, population 1,097, subsoil chiefly sand and gravel. There are about seven public pumps, the wells varying from 12 to 35 feet in depth. About three-fourths of the population derive water from the public pumps, the remainder from private shallow wells.

SIBLE HEDINGHAM, population 1,701, subsoil sand and clay. There is a public well 35 feet deep which supplies most of the inhabitants. A few houses are supplied from springs and about 20 per cent. from private wells. The wells vary from 15 to 50 feet in depth.

GREAT YELDHAM, population 595, subsoil sand and gravel. There is a public pump supplying about five per cent. of the inhabitants, about the same proportion utilise certain springs, about two per cent. depend on brooks and ditches, but the great majority have their own private wells, which are from 15 to 20 feet deep.

TOPPESFIELD, population 652, subsoil clay and chalk-stones. There are two public pumps supplying about two thirds of the inhabitants. A spring at Scotneys Farm, supplies a few houses and this spring requires protecting from pollution. There are many shallow wells, but over certain areas water is difficult to obtain and probably 10 per cent. of the whole inhabitants use pond or brook water. The wells are 30 to 40 feet deep.

LITTLE YELDHAM, population 263, subsoil clay and gravel. More than half the population is supplied from private wells or springs. A few houses have no supply

save that from brooks. The remainder is supplied from a public pump. The wells are from 15 to 50 feet deep.

TILBURY, population 170, subsoil boulder clay and gravel. There is a public spring near the church and many private wells. A few persons at the boundary of the parish are supplied from a brook or pond. One well is 220 feet deep and presumably goes into the chalk, others are from 35 to 40 feet deep.

STAMBOURNE, population 361, subsoil boulder clay and chalk. There are two public pumps supplying about one-third of the population and many private wells, 34 to 120 feet deep. About ten cottages depend on brooks and ditches.

RIDGEWELL, population 481, subsoil clay and gravel. The two public pumps supply 85 per cent. of the inhabitants. A few are supplied from private wells. The tenants of a few cottages have to go a mile for water.

GREAT MAPLESTEAD, population 375, subsoil sand and gravel. The two public pumps supply half the population. Many houses are supplied from a spring and the remainder from shallow wells, averaging 28 feet in depth.

LITTLE MAPLESTEAD, population 204, subsoil boulder clay, loam, and gravel. The public pump is over a well about 80 feet deep. The majority of the population depends upon shallow wells averaging 15 feet in depth.

PEBMARSH, population 418, subsoil boulder clay; a little gravel. There are two deep wells with pumps which supply 65 per cent. of the population. Springs and private wells supply the remainder. The spring near the King's Head requires protecting as the water is liable to pollution.

COLNE ENGAIN, population 501, subsoil gravel. A public pump supplies a small portion of the population. Most of the houses have their own wells, which are about 20 feet deep.

HALSTEAD RURAL, population 826, subsoil clay. A few houses here are supplied from the mains of the Halstead Urban District Council. There is a public well 40 feet deep, with pump, and two shallow draw wells by the roadside. A few persons depend on rain water collected from the roofs. There are many private wells. A public well at Blue Bridge would be a boon to the inhabitants near.

GOSFIELD, population 453, subsoil gravel and clay. There is no public pump, most of the population depending on shallow wells, averaging 17 feet in depth, and a few on springs.

WHITE COLNE, population 312, subsoil boulder clay. Private shallow wells about 15 feet deep supply nearly the whole parish. A few people use a spring water. There is one deep well belonging to a private owner.

EARLS COLNE, population, 1,774, subsoil clay and gravel. This is probably the most populous and important parish in the district and it is indifferently supplied with water. Mr. Reuben Hunt supplies water, from the deep well at his ironworks to most of his cottages and to a tank in the main street from which the inhabitants can fetch it without charge. There are many private wells, but as some are known to yield polluted water, often the occupants of seven or eight houses fetch water from one private well. The village requires a proper supply and if the deep well at the Ironworks, yields sufficient an attempt should be made to arrange with Mr. Hunt for a supply.

Over the greater portion of this area water is fairly easily obtainable but in Earls Colne and Halstead Rural there appears to be a demand for an increased supply. Several sources require more efficient protection to prevent pollution.

THE LEXDEN AND WINSTREE RURAL DISTRICT

Medical Officer of Health—DR. J. W. COOK, Clacton.

Clerk—C. H. TOMPSON, Esq., Colchester.

This rural district comprises 33 parishes having an area of 69,637 acres and a population of 18,572.

This area is on the London clay, capped on the west by an extensive bed of gravel and sand and on the east by boulder clay, whilst to the south the London clay is exposed. Over the gravel area water is easily obtainable from shallow wells, but on the London clay water is difficult to obtain and often deep wells when bored yield little water or water of an inferior quality. There are large springs which might be utilised for the purpose of public supplies. Rowhedge is the only village with a public supply, but in Stanway a few houses are supplied from the Colchester mains.

ABBERTON, population 199, subsoil loam. This parish is much in want of water. There are very few shallow wells. A well at Abberton House is 116 feet deep. Water is brought from a spring some distance away and sold at $\frac{1}{2}$ d. per pail. Dr. Cook has pointed out that water could be obtained at a depth of about 200 feet, but the Council think the expense of sinking such a well is greater than the parish can bear. Water is carted from a spring at Fingringhoe.

ALDHAM population 406, subsoil boulder clay and gravel. The entire supply is from shallow wells, some of which are in unsatisfactory positions.

BERGHOLT, WEST, population 1,050, subsoil London clay and gravel. Supplied chiefly from shallow wells. There are three springs near which have been protected and rendered available. There is a deep well (into the

chalk) at the Brewery. A new burial ground has been sanctioned by the Local Government Board and Dr. Cook thinks that this imperils the purity of the well waters.

BIRCH, population 759, subsoil gravel. Shallow wells supply the village. Spring water raised by a ram supplies the Hall.

BOXTED, population 680, subsoil loam. Shallow wells abound and supply all the population.

CHAPPEL, population 369, subsoil London clay and alluvium. There are shallow wells at many houses. Spring water is piped to supply other properties. A Vulcan ram raises water from a well to a tank on the top of one of the houses and from this several other houses are supplied. The waste water from this ram runs into a brook which furnishes the supply to several cottages.

COPFORD, population 651, subsoil gravel and clay. Chiefly supplied from shallow wells. At the Rectory spring water is raised by a windmill to a tank which supplies the house and a few cottages on the green.

DEDHAM, population 1,500, subsoil gravel and loam. Shallow wells abound. There is a deep well into the chalk opposite the Grammar School to which the public has access. Two or three recent wells at Stonylands reached water at about 45 feet. The parish is not well supplied and Dr. Cook points out that there is a spring above Lamb Inn corner yielding over 10,000 gallons of water per day, which could be utilised to supply the village.

DONYLAND, EAST, population 1,585, subsoil gravel. Excellent provision has now been made for the supply of the village of Rowhedge. A new bore was put down and completed in 1902, with a capital pumping station and a tower on the top of the hill above the village. The depth

of the bore is 140 feet from the surface, and it is placed at the eastern end of the village; the following is an account of the bore :—

				Depth of Strata.	Total depth.
				Feet.	Feet.
1.	Made up ground	...	...	5	5
2.	Ballast	...	...	6	11
3.	Hard blue clay	...	...	32	43
4.	Mottled clay	...	...	3	46
5.	Dark blue clay	...	...	1	47
6.	Greensand and clay	...	...	2	49
7.	Light greensand	...	...	2	51
8.	Dark greensand	...	...	9	60
9.	Dark greensand and clay	...	...	2	62
10.	Running sand	...	...	6	68
11.	Dark clay and sand	...	...	30	98
12.	Light clay and sand	...	...	2	100
13.	Sandy clay	...	...	4	104
14.	Chalk	...	...	25	129
15.	Chalk and flints	...	...	11	140

The mains are laid all over the village and a good number of the houses have had the water laid on. Steps are to be at once taken to examine the supplies to the other houses as the new supply should be generally used. The outlying houses are supplied by shallow wells, the expense of carrying the mains to the outlying parts being prohibitive.

EASTHORPE, population 120, subsoil gravel and boulder clay. Supplied from shallow wells and a spring.

FINGRINGHOE, population 534, subsoil loam and gravel. Supplied from two public springs and a few shallow wells. There is an excellent spring near the school, which is protected to prevent pollution. Water is raised by means of a pump. A new pump is needed,

Water is carted from here to supply parts of Abberton and Langenhoe.

FORDHAM, population 661, subsoil boulder clay and gravel. Water is obtained from shallow wells exclusively.

HORKESLEY, GREAT and LITTLE, population 919, subsoil gravel and boulder clay. Chiefly supplied from shallow wells. One spring supplies several houses.

INWORTH, population 171, subsoil gravel. Supplied from shallow wells.

LANGENHOE, population 219, subsoil loam and clay. Very badly off for water which has to be carted long distances. At the Hall a well has been bored to a depth of 300 feet and the water is raised by a windmill pump. There is a good yield of excellent water and it would be a boon to the parish if an arrangement could be made with the owner to supply the water to the houses around.

LANGHAM, population 560, subsoil gravel. Supply from shallow wells.

LAYER BRETON, population 248, subsoil London clay with local gravel patches. The supply is inadequate, water only being obtainable from shallow wells at a few places.

LAYER-DE-LA-HAYE, population 618, subsoil gravel and clay. Supplied from shallow wells. Some concrete tube wells have recently been made to supply two groups of cottages.

LAYER MARNEY, population 226, subsoil London clay. This parish is not well supplied. Dukes Farm is supplied from a spring some distance away, Palmer's Farm by a well 65 feet deep, and the Towers by a well 500 feet deep.

MERSEY ISLAND, EAST MERSEY, population 218, WEST MERSEA, population 1,304, subsoil London clay with a little gravel. Both parishes are chiefly supplied from shallow wells. There are a few Abyssinian tube

wells. A public supply would be a great acquisition to West Mersea and there is an abundance of spring water available.

MESSING, population 731, subsoil London clay and gravel. There are a few shallow wells. The brewery is supplied by a very deep well in the chalk. The village is chiefly supplied from a spring the water being carried by a pipe to a convenient centre. The water supplying Tolleshunt Knights in the Maldon Rural District is obtained from the gravel patch in this parish.

MOUNT BURES, population 220, subsoil gravel and clay. Shallow wells are the sole source of supply.

PELDON, population 422, subsoil London clay. Water is far from abundant. There is a deep well opposite Brick Farm House which is not rendered so available as it might be. Water is carted from here to houses in the parish. At the outskirts there are a few shallow wells.

SALCOT AND VIRLEY, population 206, subsoil London clay. The only water obtainable here is from ponds and ditches. A better source is greatly needed.

STANWAY, population 553, subsoil gravel and sand. The houses in the London Road as far as Beacon End are supplied by standpipes connected to the Colchester mains. A rate is charged on all houses within 200 feet of a standpipe unless having a good independent supply. At Cherry Tree Farm on the London Road, a well has been bored to a depth of 300 feet and an abundance of water obtained from the chalk. This well would supply London Road and the Workhouse if needed. The supply to the Workhouse is said to be not too abundant. There are many shallow wells.

GREAT AND LITTLE TEY, population 648, subsoil boulder clay. The supply is chiefly from shallow wells.

Two public wells in Great Tey have recently been lined with glazed earthenware tubes.

MARKS TEY, population 530, subsoil brickearth. Supply chiefly from shallow wells. At Long Green a well has been sunk by a private owner from which water is pumped to a tower to supply a number of cottages.

WIGBOROUGH, GREAT AND LITTLE, population 260, subsoil London clay. Chief supply from ponds and ditches. Most of the farmers cart water from St. Peter's Well, West Mersea. There is a deep well on Copt Hall marsh for the supply of cattle.

WORMINGFORD, population 380, subsoil loam and clay. There are a few shallow wells. Mr. Tufnell has sunk a deep well into the chalk to supply his cottages and at the Rectory water is obtained from a spring piped from an adjacent hill.

Many parishes in this district are inadequately supplied with water yet in probably all cases plenty of good water could be obtained at a depth of from 200 to 300 feet by sinking or boring wells into the chalk.

THE TENDRING RURAL DISTRICT.

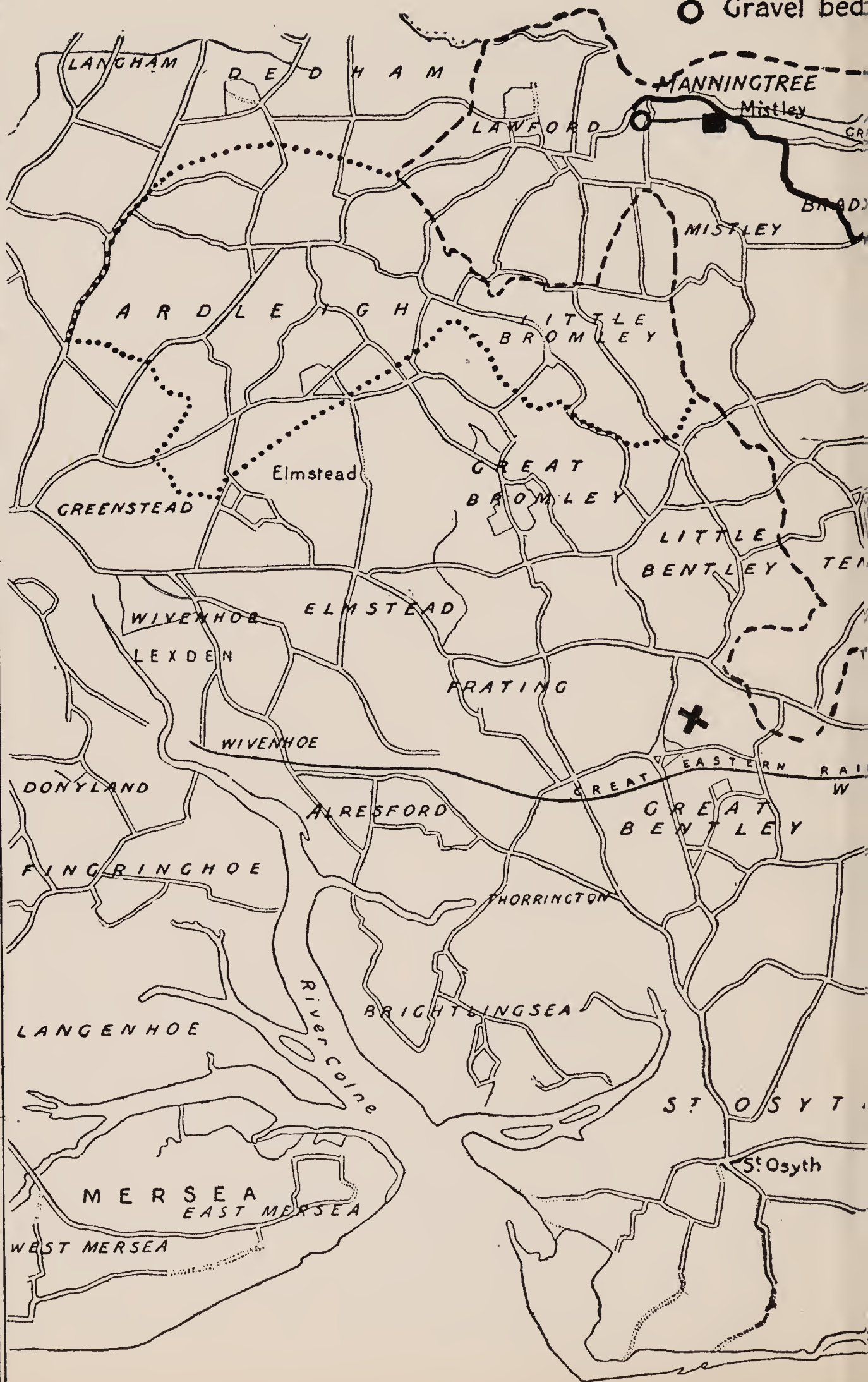
Medical Officer of Health—DR. J. W. COOK, Clacton on-Sea.

Clerk—A. J. H. WARD, Esq., Harwich.

This is an extensive district bounded by the sea on the east and by the tidal Stour on the north. It has an area of 73,286 acres and a population of 20,983 in 27 parishes. Most of the area is covered with water bearing gravel, but a few parishes are on the London clay. As the Tendring Hundred Waterworks are in this district and the Company has power to supply water to most of the parishes, a few details with reference to it may be useful.

TENDRING HUN

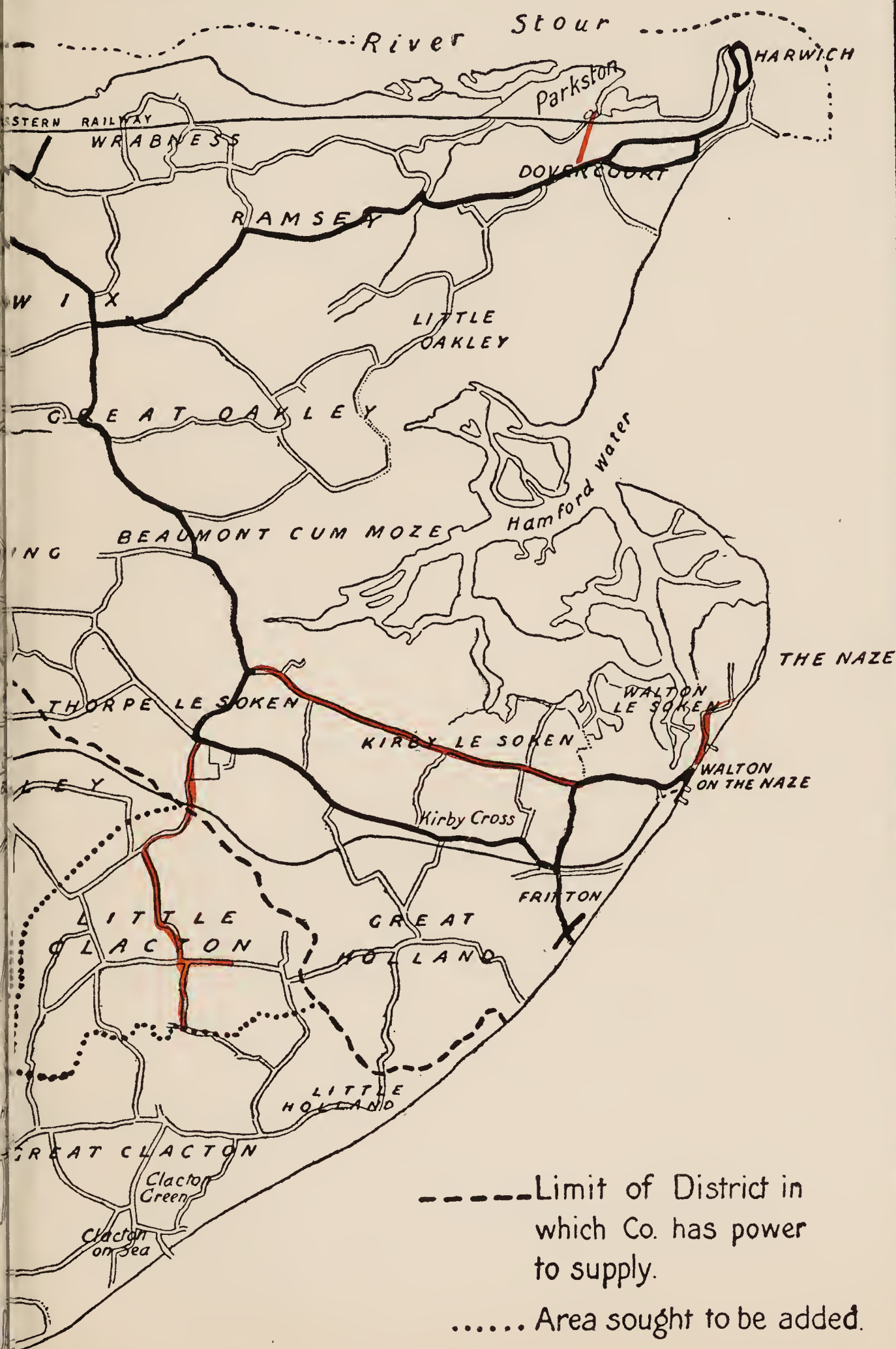
- Well and
- Gravel bed



ED WATERWORKS COMPANY

ping station

— Trunk mains



(X Site of proposed well for Clacton supply)



The Company was incorporated by Act of Parliament in 1884 and obtained extended powers in 1886 and 1901. Their area of supply includes 22 parishes, shewn in the accompanying map. At present the water supply actually extends to 15 of these. The additions to the Company's area under their Act of 1901 included the parishes of Ardleigh, Little Bromley, and Little Clacton. The water supply has been taken to Little Clacton and also to Tendring while many minor extensions have been made. Generally during the last three years the means of distribution has been greatly improved.

The Company have their headquarters at Mistley where are situated the two deep bores into the chalk from which the whole of the water supplied by them is derived, and their pumping station is at Mistley a little north of the railway. The Company are sinking a new well into the chalk at Lawford about one mile from the Mistley well where it is expected an abundant supply of pure and wholesome water will be obtained. It is intended to erect improved modern plant capable of delivering any quantity of water that may be required for many years to come.

The water is pumped direct into the mains under a pressure of 200 feet and after supplying the villages en route is driven into the reservoirs at Dovercourt and Kirby. At the former place storage is provided for 375,000 gallons, while at the latter the provision is for 75,000 gallons mainly intended for the supply of Frinton-on-Sea and Walton-on-Naze. High level tanks have been erected to ensure a proper supply to the higher parts of the Company's districts. The route of the mains is shewn on the accompanying map.

ALRESFORD, population 249, subsoil chiefly gravel. Water is derived from shallow wells about 12 feet deep. An attempt to drive tube wells was unsuccessful as a

layer of ironstone was met with which was so hard as to prevent the tube being driven deeper. The ironstone is at a depth of about 10 feet, and is very local.

ARDLEIGH, population 1,426, subsoil sandy loam. Supplied from wells 3 or 4 to 20 feet deep. Neither the quality nor quantity is satisfactory and a public supply is needed. It is within the area of the Tendring Hundred Water Co., but to supply it four miles of mains would have to be laid along a route on which there is little demand for water, and unless the Tendring Rural District Council guarantee the Company seven per cent. on their outlay the supply cannot be demanded. Apparently the Rural District Council does not see its way to give this guarantee. There is a good deal of water in the gravel here outside the village, but probably it would cost more to utilise this than to obtain a supply from the Water Co.

BEAUMONT, population 385, subsoil clay and shelly sand. The trunk main of the Water Co. passes through this parish but apparently supplies no houses. There are a few wells, some of considerable depth, but a few persons have to fetch water from a distance.

BENTLEY, GREAT, population 1,156, subsoil loam, clay and gravel. Water is abundant on the gravel but scarce elsewhere and the supply generally is insufficient. The Urban District of Clacton obtains its supply at present from the Bentley gravel and are under obligation to supply the parish in bulk at the rate of 1s. per 1,000 gallons, but the Parish Council apparently is averse to providing the necessary tank and mains, although Dr. Cook thinks the most populous part of the parish can be supplied at a cost of about £300.

BENTLEY, LITTLE, population 291, subsoil loam and gravel. The supply is from shallow wells. There are some good springs here and one which was used during

the Manœuvres of 1904 could be made to supply the village.

BRADFIELD, population 730, subsoil gravel and loam. The Tendring Hundred Water Co. have a reservoir here and their mains supply certain houses, but many others could be connected with advantage. Others are supplied from shallow wells.

BROMLEY, GREAT AND LITTLE, population 889, subsoil gravel and loam. Almost entirely supplied from shallow wells. At Great Bromley Lodge water is obtained from a bored well about 400 feet deep.

CLACTON, LITTLE, population 664, subsoil London clay. The Tendring Hundred Water Co. have extended their mains all over the village except the St. Osyth Road and such houses as have not a private and satisfactory source of supply are now connected to the mains.

ELMSTEAD, population 893, subsoil gravel and loam. There are several scattered hamlets deriving water from shallow wells. The supply is not altogether satisfactory.

FRATING, population 213, subsoil gravel and loam. The Hall is supplied from a brook, the water being raised by a ram. Cottages supplied from shallow wells. A tube well recently put down at the Rectory cottages is 17 feet deep.

HOLLAND, GREAT, population 413, subsoil London clay and gravel. Water is much wanted here as water is only obtainable locally from the gravel. Dr. Cook suggests the extension of the Tendring Hundred Water Co's. mains to the village as this could be done at a small cost and would be a great boon to the inhabitants.

HOLLAND, LITTLE, population 92, subsoil gravel. This parish is at present supplied from shallow wells, but if the building estates laid out are developed it will be

advisable to approach the Clacton Urban District Council in order to obtain a supply from their mains.

KIRBY, population 914, subsoil sandy loam and clay. The mains of the Tendring Hundred Water Co. now pass through both Upper and Lower Kirby and any house can obtain a supply therefrom. A spring supply is piped to stand pipes in Lower Kirby for the gratuitous use of the inhabitants.

LAWFORD, population 809, subsoil gravel. The Tendring Hundred Water Co. are sinking a deep well here, and supply a few houses. Wignall Street has a good supply which is gathered from a hill above the village and conveyed thereto in stoneware pipes. Much of this water now runs to waste but could easily be utilised. Outlying houses are supplied by wells, some shallow, some deep.

MANNINGTREE, population 872, subsoil gravel. Many of the houses are supplied by the Water Co., but a few still use water from shallow wells.

MISTLEY, population 1,656, subsoil gravel. There is a free public supply piped from a tank or collecting reservoir in the Furze Hills, but the Tendring Hundred Water Co. also supply here.

OAKLEY, GREAT AND LITTLE, population 1,081, subsoil gravel. Entirely supplied from shallow wells.

RAMSEY, population 2,535, subsoil chiefly gravel. This parish comprises the villages of Ramsey and Parkeston with its quay. The Tendring Hundred Water Co's. mains extend through both villages and supply most of the houses. Off the route of the mains water is obtained from shallow wells.

ST. OSYTH, population 1,404, subsoil chiefly gravel. The parish depends on shallow wells, but a better supply is desirable. There are some excellent springs which might be utilised, but it would probably be better to

arrange for a supply from the Clacton mains which traverse the village.

TENDRING, population 770, subsoil gravel. Supplied chiefly from shallow wells and a better source is much needed. The Guardians spent a considerable sum in attempting to get a supply for the Union House from a deep well, but failed and have had to arrange with the Tendring Hundred Water Co. to carry a main from Wix Cross to the Union House. The main is of little use for the parish generally, it requires extending and no doubt the Company would undertake this were the necessary guarantee forthcoming.

THORPE, population 1,065, subsoil London clay chiefly. The Tendring Hundred Water Co's. main passes through the parish and supplies many houses, others utilise shallow wells.

THORRINGTON, population 382, subsoil gravel and loam. Supplied entirely from shallow wells.

WEELEY, population 542, subsoil gravel and clay. There are a few shallow wells but water is much wanted in many parts of the parish. A supply could be obtained from the Tendring Hundred Water Co. if the necessary guarantee were forthcoming.

WIX, population 609, subsoil loam. The recent extension of the Tendring Hundred Co's. water main through Wix to Tendring will enable many houses to be supplied which previously were badly off for water. There are many shallow wells.

WRABNESS, population 300, subsoil loam. The supply is entirely from shallow wells. Such a well has recently been sunk to supply the new school house.

As the mains of two water companies traverse this district there ought to be little difficulty in providing water for all the more populous parishes. The Tendring

Hundred Co. cannot compel the inhabitants to purchase water from them, but the Rural District Council can compel every owner of property within a certain distance of the mains to obtain a supply therefrom if the existing private source of supply is not satisfactory. It is a matter for regret that more houses are not connected as this would encourage the Water Company to make further extensions. There is no doubt that an arrangement whereby the mains could be carried to Weeley, Great Holland, and Tendring village would be of great advantage to the district. An arrangement should also be made, if possible, with the Clacton Urban District Council for the supply of water to Great Bentley and St. Osyth.

THE BELCHAMP RURAL DISTRICT.

Medical Officer of Health—DR. J. SINCLAIR HOLDEN,
Sudbury.

Clerk—H. C. CANHAM, Esq., Sudbury.

This district comprises 17 parishes with an area of 26,548 acres and a population of over 4,847. The underlying geological formation is chalk which is covered on the higher ground with Boulder clay and in the valleys with drift sand and gravel or brickearth. The chalk is exposed over a very limited area. Water is not carried by mains through any portion of the district. Dr. Holden summarises the supplies to the whole district as under :—

	Per cent.
Population supplied from public pumps ...	24·6
„ „ „ springs ..	6·6
„ „ „ private wells ...	52·8
„ „ „ rain water tanks ...	·2
„ „ „ ponds ...	14·8
„ „ „ brooks and ditches...	1·0

The population is very scattered and the most populous parish does not contain 750 people.

ALPHAMSTONE, population 231. Supplied by a public spring, a few private wells, but many houses are supplied from ponds.

BELCHAMP OTTEN, WALTER, AND ST. PAULS, population 1,164. There are two public wells in Belchamp St. Pauls, but Belchamp Walter and Otten are dependent on ponds and a few private wells. An attempt was made to purify the pond water by passing it through a filter into a well, but the result was so unsatisfactory that the filter was removed. Attempts elsewhere to filter pond water have resulted in making the water worse than before.

BORLEY, population 146. A tube well has recently been sunk here for a public supply. Chalk was reached at 82 feet. The boring was continued to 126 feet when sufficient water was obtained.

BULMER, population 718. Is in part supplied by two deep wells, but many houses are supplied from ponds. The owners of 22 cottages recently combined and sank a well obtaining a good supply of water at 50 feet.

BURES, population 500. There is a public well fed by a spring which furnishes most of the supply.

FOXEARH, population 382. There is a spring supply and a few private wells, but Mr. Ward has recently erected a standpipe at the road side near the brewery and supplies it with water from the deep well on the premises.

GREAT AND LITTLE HENNY, population 272. Supplied from a spring, private wells, and ponds.

GESTINGTHORPE, population 475. There is one public well upon which most of the parish depends. Those at a distance from the well rely chiefly upon ponds, there being few private wells.

LISTON, population 77, is supplied by a well. LAMARSH, population 191, depends chiefly on a stream, whilst MIDDLETON, population 142, has two public wells fed by springs.

PENTLOW, population 274. The supply here has been improved during recent years by the Sanitary Authority sinking a well. Water of good quality was reached at 30 feet whereas the one existing private well was 100 feet deep.

TWINSTED, population 145, has two public wells one of which has recently been deepened over 40 feet on account of the failure of the supply. This well is now 82 feet deep.

WICKHAM ST. PAUL, population 253, is chiefly supplied by a public well in the chalk. This also had to be deepened last year in consequence of the fall in the water level.

In this district it is obvious that the Sanitary Authority is anxious to render a supply of water available in every parish by sinking wells into the chalk and probably under the circumstances this is all that can reasonably be done. The population has considerably decreased since the census of 1891.

THE BUMPSTEAD RURAL DISTRICT.

Medical Officer of Health—DR. W. ARMISTEAD, Stapleford, Cambridge.

Clerk—S. A. BIGMORE, Esq.

This district lies almost entirely in the valley of the Stour, with an elevation of from 170 to 400 feet above sea level. The area is 11,856 acres, and the population of its six parishes is 2,541. The chalk underlying the whole district is covered with gravel and alluvium in the valley and with boulder clay on the higher ground.

ASHEN, population 222, subsoil boulder clay and gravel. Supplied by a few private wells and by rain water. There is a spring near which could be utilized for supplying most of the population.

BIRDBROOK, population 435, subsoil boulder clay. Chiefly supplied from two deep wells.

HELION BUMPSTEAD, population 576, subsoil boulder clay. There are two public wells, 166 feet and 83 feet deep respectively upon which the parish chiefly depends.

STEEPLE BUMPSTEAD, population 854, subsoil gravel and clay. There are many shallow wells, but a considerable portion of the population derive water from two ponds, one at White's Farm and the other at Jacob's Farm. An attempt is made to purify these waters by allowing them to filter through polarite and sand into wells.

OVINGTON, population 126, subsoil boulder clay. The supply is from a public well which is sunk 95 feet and bored 100 feet. The water comes from the chalk. The supply is not too abundant.

STURMER, population 328, subsoil boulder clay and gravel. The numerous shallow wells fairly meet the requirements of this parish.

This district has suffered greatly from want of water during years of low rainfall.

NOTES ON THE WATER SUPPLY TO ISOLATED HOUSES AND SMALL GROUPS OF COTTAGES.

The Public Health (Water) Act, 1898, was doubtless passed with the intention of ensuring the provision of wholesome water to isolated houses, small groups of cottages, and to all newly-erected houses in districts too thinly populated to permit of a public supply. It has now been in force for over twenty years, and has signally failed in its intentions, as in probably every rural district there are still to be found large numbers of cottages without any proper supply of water. Ponds, ditches, polluted streams, and polluted wells are still used in thousands of instances. The sympathies of the framers of the Act appear to have been on the side of the owners of existing property, since many difficulties are placed in the way of sanitary authorities, and the owners are afforded many excuses for delay and many grounds for appeals to the Local Government Board.

No *newly erected* house can be legally occupied until the owner has obtained a certificate from the sanitary authority to the effect that it has got a good and available water supply within a reasonable distance, yet certificates are granted on supplies which are often most unsatisfactory. They are granted on supplies which can only be obtained on sufferance, of which the tenant may be deprived without notice, and of which he often is deprived when the supply becomes limited ; on supplies which are at an unreasonable distance ; and on supplies which are polluted or liable to pollution. Authorities should insist upon the source being satisfactory and within a reasonable distance. The inspector or medical officer of health should examine the source, and it is desirable that a sample of the water should be submitted to analysis.

A certificate should be resolutely refused unless both the water and its source are perfectly satisfactory. Where the supply is to be from a shallow well, the owner and builder should know that the well will not be accepted as a satisfactory source of supply unless it is properly constructed and properly situated. For this purpose the Chelmsford Rural Council have had printed the following instructions which I strongly recommend to the consideration of other authorities :—

THE RURAL DISTRICT COUNCIL OF CHELMSFORD.

The Construction of Shallow Wells.

In the large majority of cases where shallow wells yield polluted water it is due to defects in the construction of the wells. The following suggestions are submitted by the Chelmsford Rural District Council, upon the advice of their Officers, for the construction of such wells. The water which enters a well at a depth of six to twelve feet, depending upon the porosity of the soil, is usually efficiently filtered and purified. Water entering at a less depth is nearly always liable to be imperfectly purified and unsatisfactory in quality. The nearer the ground surface at which water can enter the greater the danger of pollution.

It follows therefore that the upper six to twelve feet of the well should be water tight and that the top should be so finished off that no surface water can possibly gain access. It is also very desirable that the top of the well should be brought up six to twelve inches above the ground surface and covered with a proper flagstone or wood or iron cover.

As no new house can be occupied without a certificate from the Sanitary Authority to the effect that the house has a sufficient supply of wholesome water, it is

important that builders and others should pay particular attention to the above suggestions and so avoid the risk of a certificate being refused.

*Issued by Order of the Rural District Council of
Chelmsford.*

JAS. DEWHIRST,

Surveyor and Engineer.

If authorities would insist upon the proper construction of wells the water supplies of our rural districts might be gradually improved.

Samples of water from existing shallow wells should be taken for analysis, and if found impure action should be taken under Section 3 of the Public Health (Water) Act, and a proper well insisted upon if it can be provided within the cost stipulated in the Act. Only in exceptional cases is it possible to construct properly a shallow well and fix a good pump for £8 13s. 4d., and even the maximum expenditure, which can only be enforced after getting the sanction of the Local Government Board, (£13) may not be sufficient if the well is any depth. Unfortunately also it rests with the Sanitary Authority to prove that the supply can be obtained at a reasonable cost defined by the Act, if this is not done proceedings before a Court of Summary Jurisdiction will be futile. The Local Government Board have also held that where the same owner has a number of cottages, even if they are in a row, the cost must include the laying on of the water to each, so that it is impossible for instance to make a man spend £20 in constructing a well for three or more houses unless the well is so near that each house can have a pump on its own premises. If the well is a little distance away this becomes impracticable. This appears to me to be an absurd interpretation of the Act, and in Essex it has prevented many improvements which would otherwise have

been carried out. If the absence of a proper water supply creates so great a nuisance that the house is unfit for habitation, proceedings might be taken for obtaining a Justice's order prohibiting its being used for human habitation, but I have never heard of such an order being applied for in a rural district, and I doubt very much whether any Justice could be found in England who would grant one.

At the present time an order for closing a well cannot be procured unless the Medical Officer of Health can prove that the water is injurious to health, whereas it should be sufficient to prove that it is dangerous to health. Gunpowder and other explosives are not injurious to the health of people near, but Government places great restrictions on their storage on account of the danger of explosion. A polluted water may be generally harmless, but we know that sooner or later it will become specifically polluted and cause disease, yet until it actually is causing disease we cannot legally prevent its use. Why, again, should a Sanitary Authority have to appeal to a Government department to define a "reasonable" cost? surely the Court of Summary Jurisdiction or the County Council could deal with such comparatively trivial matters, even if the sanitary authorities are not to be trusted.

Stringent bye-laws can be adopted preventing privies or cesspools being placed within so many feet of a well or source of water supply, yet that source may be an improperly constructed well in the centre of a garden, and the privy and cesspool contents may be spread on the ground or dug in right over the well. No bye-laws can be made to insist upon a well being properly built, or the ground around being protected by being made impervious. The method of procedure enabling Sanitary Authorities to provide wells or other sources of supply in convenient

situations, and to charge the cost on all owners within a certain radius whose tenants have not a wholesome supply, requires simplification. In all hamlets and villages, too small for a public supply to be laid on to each house, I think the Sanitary Authorities should provide wells or protect springs in central positions, and maintain the same at the expense of the parish. This would ensure that every aggregation of houses had within a reasonable distance an available supply of wholesome water. There are large numbers of parishes without any public well of this character. Again, Sanitary Authorities are often remiss in not properly protecting existing public supplies. They should set builders and owners an example by causing all public wells to be properly constructed and protected. Springs in roadside ditches abound which have been used by the public from time immemorial. These are public supplies, yet they are fouled by every rainfall, by passing cattle, by tramps, &c. These sources, if really necessary, could be and should be greatly improved.

The present condition of rural water supplies is in a great measure due to defects in Acts of Parliament ostensibly passed for removing the evils which they perpetuate. The Sanitary Authorities are, as we have seen, powerless to compel an owner to provide a well or other source of supply of water unless they can prove that the supply can be obtained for each separate cottage at a certain cost, nor can they obtain an order for closing a polluted well without appearing before the Court and proving that the water therefrom is actually injurious to health. These facts should be borne in mind by those who attack Sanitary Authorities and charge them with being responsible for existing conditions. Where the Sanitary Authorities fail is in not taking full advantage of the existing public sources of supply, and in providing

additional public supplies. In many districts through which water mains pass, persons are allowed to continue to use water from sources of an objectionable character instead of being compelled to take water from the public mains. The following sections of the Public Health (Water) Act are of such importance that I may be allowed to quote them here:—

7. It shall be the *duty* of every Rural Sanitary Authority from time to time to take such steps as may be necessary to ascertain the condition of the water supply within their district, and the Authority may pay all reasonable costs and expenses incurred by them for the purpose of taking such steps.
2. It shall be the duty of every Rural Sanitary Authority to see that every occupied dwelling house within their district has within a reasonable distance an available supply of wholesome water sufficient for the consumption and use for domestic purposes of the inmates of the house.

Where, on the report of the Medical Officer of Health or Inspector of Nuisances, it appears to such Authority that any house has not a proper supply, the owner may be served with a notice to provide a supply (assuming always that it will not cost more than a capital sum [£8 13s. 4d.], the interest on which at the rate of five per cent. will amount to 2d. per week) and if he fails to do so the Authority can provide the supply and charge the owner with the expense.

These sections, as we have seen, are practically useless where water has to be obtained from wells, but where water mains pass near the premises they afford the Sanitary Authority all the power necessary to compel the owner to connect his premises with the water main,

Where private companies cannot afford to provide supplies the Sanitary Authority should undertake the duty wherever there is any considerable number of houses without a proper supply. This may entail the sinking of a well and fixing a pump, the piping of a spring, or the establishment of waterworks. The present report gives many instances where works of this kind have been successfully carried out in the county and what has been done in one district can be done in another if only the Authority acknowledges its responsibilities and determines to carry out conscientiously the duties placed upon it by Parliament.

For the information of the Rural District Councils and the County Council, a paragraph has been appended to the report on each Rural District pointing out the improvements required. These should receive especial attention in the near future. District Councils are also strongly urged not to grant certificates to new houses unless the supply of water is satisfactory, taking into consideration all the circumstances in each case. The powers given by the Public Health (Water) Act may be so used as to discourage the erection of cottages, but with the exercise of a little tact, this danger may be avoided.

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